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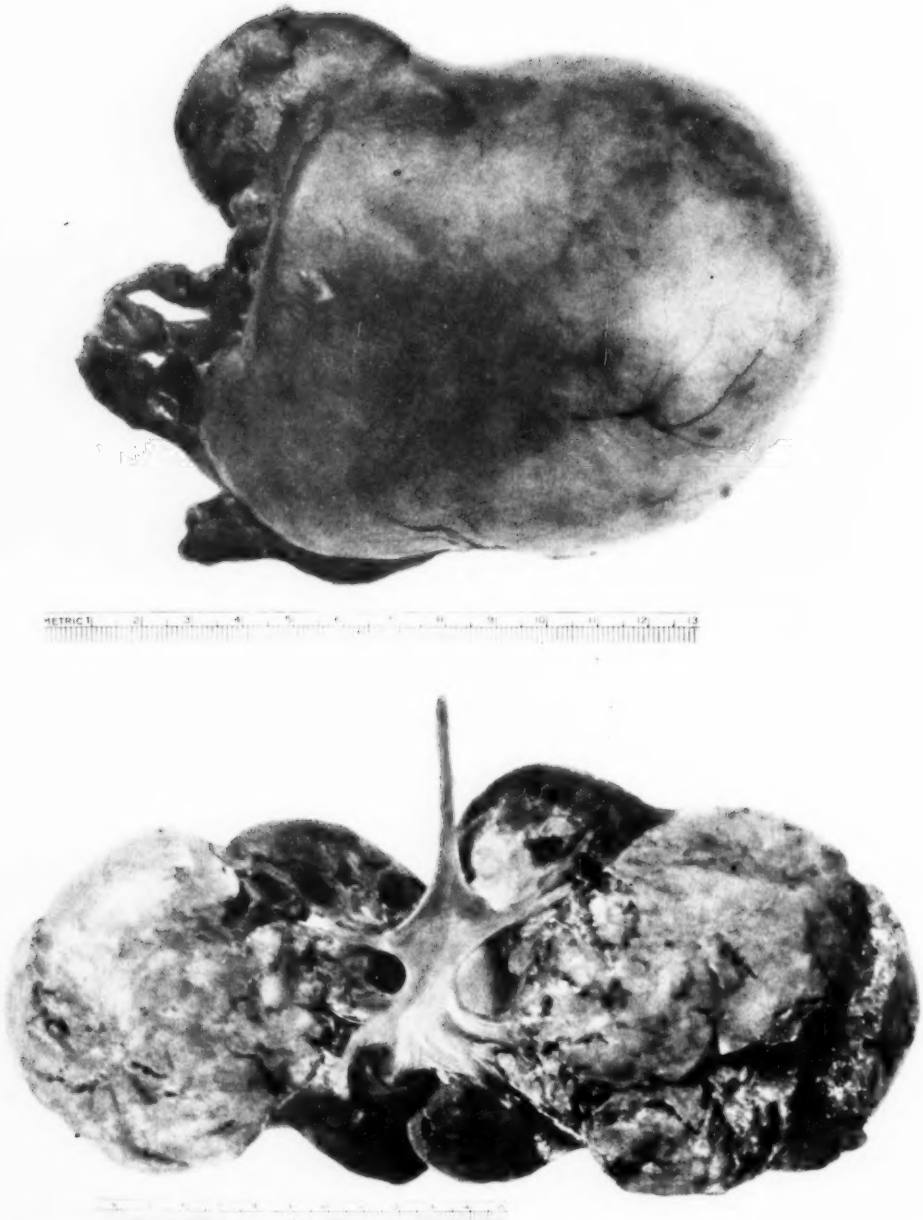

Fig. 2. (A) Lipoma viewed through capsule of kidney. (B) Cut surface of lipoma and kidney, showing mottled surface and encapsulation.

Massive Lipoma of the Kidney.—William E. Lower and George W. Belcher.

SURGERY, GYNECOLOGY AND OBSTETRICS

AN INTERNATIONAL MAGAZINE, PUBLISHED MONTHLY

VOLUME XLV JULY, 1927 NUMBER 1

MASSIVE LIPOMA OF THE KIDNEY

WITH REPORT OF A CASE

BY WILLIAM E. LOWER, M.D., F.A.C.S., AND GEORGE W. BELCHER, M.D., CLEVELAND, OHIO
Cleveland Clinic

LIPOMATA of the kidney are of quite rare occurrence. They are usually very small, not larger than a cherry, and may be mistaken for metastatic growths, benign adenomata, or even hypernephromata, as the last of these are often very rich in fat.

When lipomata of the kidney are present in persons who have died from septicæmia, they may be mistaken for metastatic abscesses. In a rather thorough survey of the literature we have been able to find only 5 proven cases in which lipomata have attained an unusual size. We add the following case report to this very small group.

CASE REPORT

On December 21, 1925, a white woman, 52 years of age, came to the Cleveland Clinic complaining of pain, contraction of the rectum, indigestion, and nervousness. The familial and past histories were unimportant. She stated that this illness began in February, 1925, with trouble in evacuating the bowels and resultant small stools. Increasing difficulty and pain caused her to consent to an operation in the hope that the rectal condition might be corrected. (This was probably a dilatation under a general anæsthetic.) Shortly before her visit to the Clinic she began to have almost constant indigestion and pain in the epigastrium, associated with gas and with nervousness which began to increase very much shortly before she came for examination. During the preceding month she had lost 12 pounds in weight. She complained of a great deal of headache in the parietal region, of being dyspnœic, very weak, and constipated. Because of the pain in the stomach she slept very poorly. The menopause had just been passed. The only urinary symptom was occasional nocturnal micturition.

Examination disclosed a well developed but rather emaciated elderly woman who appeared to be very much worried and ill. There was a fine involuntary tremor of the head (Parkinsonian syndrome) and an external strabismus of the left eye which she stated had been present for a month. Except for tenderness and a palpable mass in the left kidney region, the physical examination disclosed no abnormality.

Although it was assumed that the mass was connected with the kidney in view of the symptoms of indigestion and constipation, an X-ray examination of the gastro-intestinal tract was made. The findings in this examination were normal. The blood sugar, blood counts, hæmoglobin and the urinary findings were also normal. The cystoscopic examination of the bladder disclosed no abnormality. A pyelogram of the left renal pelvis, however, showed a deformity (Fig. 1, *A* and *B*) which strongly suggested the presence of a new-growth.

In view of the pyelographic finding an operation was recommended. At operation the kidney was found to contain a large, subcapsular yellow tumor which was very friable and looked not unlike a hypernephroma (Fig. 1, *C*).

This growth, which seemed to involve the entire mid-portion of the kidney, extended down into the hilus and over toward the spine retroperitoneally. Everyone present at the operation believed that the condition was malignant, and we were therefore surprised by the following pathological report.

Pathological report. The gross specimen is an enlarged left kidney weighing 420 grams. In the middle on the lateral surface there is a large globular, subcapsular tumor mass which when viewed through the capsule had a yellowish appearance (Fig. 2, *A*). On section, it is seen to be about 4 inches in diameter

Fig. 1A.

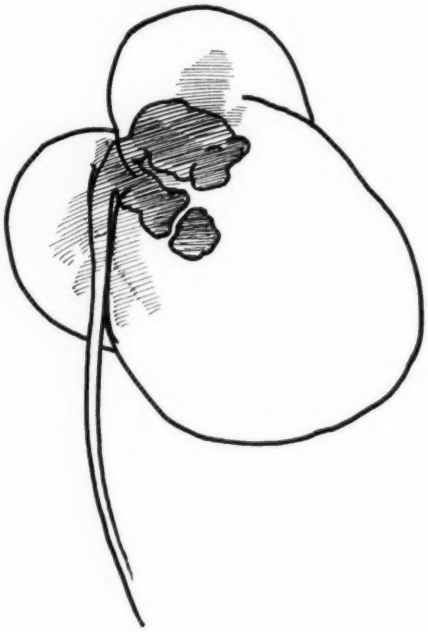

Fig. 1B.

Fig. 1. *A*., Appearance of lipoma of kidney on pyelogram. It was necessary to take the pyelogram while the gastro-intestinal tract contained bismuth. *B*, Diagrammatic representation of lipoma of kidney. Outline of specimen superimposed upon that of pyelogram. *C*, Kidney containing lipoma, after nephrectomy. Pelvis filled with a 15 per cent solution of sodium iodide and vessels injected with bismuth subnitrate.

and fairly well encapsulated, the cut surface presenting a fatty yellowish mottled appearance. The renal vessels do not appear to be involved. The renal pelvis is very much narrowed by the compression of the tumor mass upon it. The tumor is very friable (Fig. 2, *B*).

Microscopic sections taken through the growth show similar pictures, characterized by a typical lipomatous structure which consists of a reticular fibrous connective tissue surrounding vacuolated spaces from which the fatty substances have been dissolved. In a few areas around the fairly numerous large blood vessels there are aggregations of somewhat proliferative fibroblastic elements (Fig. 3).

The pathological diagnosis was renal lipoma (fibrolipoma).

The patient made an uneventful postoperative recovery. In view of the fact that these growths are thought to recur locally she was later given a short course of deep X-ray therapy. On July 23, 1926, the daughter of the patient reported that her mother was up and about, was eating well, and was doing some housework. The pain and constipation had disappeared, and there was no frequency of urination. There were no signs of local recurrence. The Parkinsonian syndrome was unchanged.

GENERAL DISCUSSION

True lipomata of the kidney must not be confused with the lipomatous deposits around the pelvis which occur in atrophic diseases of the kidney, first described by Virchow; or with the enormous perirenal tumors first presented by Salzer (10). Tumors of the latter type often so envelop the kidney that it may at first be assumed that the growth is primarily renal. Such cases have been reported fairly frequently (Holmes, 6, V. Cantoni, 4, Samuels, 11). Furthermore, it should be remembered that a lipomatous deposit in the kidney may be part of a general tendency of the body similar to fibromatosis.

PATHOLOGY

Ewing (5) states that lipomata of the kidney originate in two sites: (a) the under sur-

face of the renal capsule, and (b) the hilum. The pelvic lipoma, therefore, may be an extension from the cortical growth. This was the condition in our case in which there was a marked increase of the peripelvic and retroperitoneal fat which was granular in appearance and looked not unlike a rapidly growing, very cellular "fatty" hypernephroma. As Keenan and Archibald (7) have stated, the finding of a collection of fat in an organ in which fat normally is not seen should surely awaken one's curiosity. These authors, who have presented a most thorough pathological review of the subject, have proven that these lipomata fall into this class.

On the basis of the gross pathological appearances, Keenan and Archibald make the following classification of fatty growths in the kidney:

"(1) The typical hypernephroma, looking like a lipoma; (2) the true lipoma; (3) the combination of these two in one nodule, lipohypernephroma, if we may call them so, each element remaining separate; (4) the lipo-myoma, or lipo-myo-sarcoma, of Mueller; and (5) the degeneration lipoma of Ulrich."

Various articles on these subjects concerning the controversy between Grawitz (quoted by Warthin, 13), Virchow (quoted by Warthin, 13), Selter (12), and Beneke (3), have led us to the following conclusions:

1. The occurrence of lipomata in the kidney is rare.

2. Before the diagnosis of lipoma is made, one should make sure by microscopical examination that the suspected growths are not adenomata or adrenal rests.

3. Although lipomata of the kidney are usually small—rarely larger than a cherry—5 cases in which they have attained considerable size have been reported (Warthin, 13; Grawitz; Bartsch, 2; Alsberg, 1; and Keenan and Archibald, 7).

4. Degeneration of lipomata or the replacement of normal tissue by lipomatosis secondary to calculus, tuberculosis, inflammatory atrophy, or operative trauma (Masson and Horgan, 9) are not rare. These arise from the fat around the pelvis.

Paul Manasse (8) discussed true lipomata of the kidney but mentioned only those of

Fig. 1C.

smaller size. He thought they were due to a displacement of the fatty tissue of the capsule to the kidney parenchyma and not to a changing of the kidney connective tissue into fat.

Beneke (3) thought that lipomata might be due either to displacement of fatty tissue or to a metaplasia of the original kidney connective tissue, as the lipoma arborescens arises from tendinous articular ligaments. He gives this conclusion after an examination of 3 cases; but since no definite description of the growths in his series is given, particularly as to their size, and since no case reports were included, we could not include Beneke's cases in this collection of massive lipomata.

SYMPTOMS

The principal symptoms of lipomata of the kidney, which are usually mild, are pain or discomfort in the region of the involved organ, these symptoms varying with the size of the growth. Hæmaturia is seldom encountered; constipation and gastric symptoms may be present. In our case the symptoms were at first thought to be due to a disorder of the gastro-intestinal tract.

DIAGNOSIS

Lipoma of the kidney occurs in middle age; and all the reported cases have been in women.

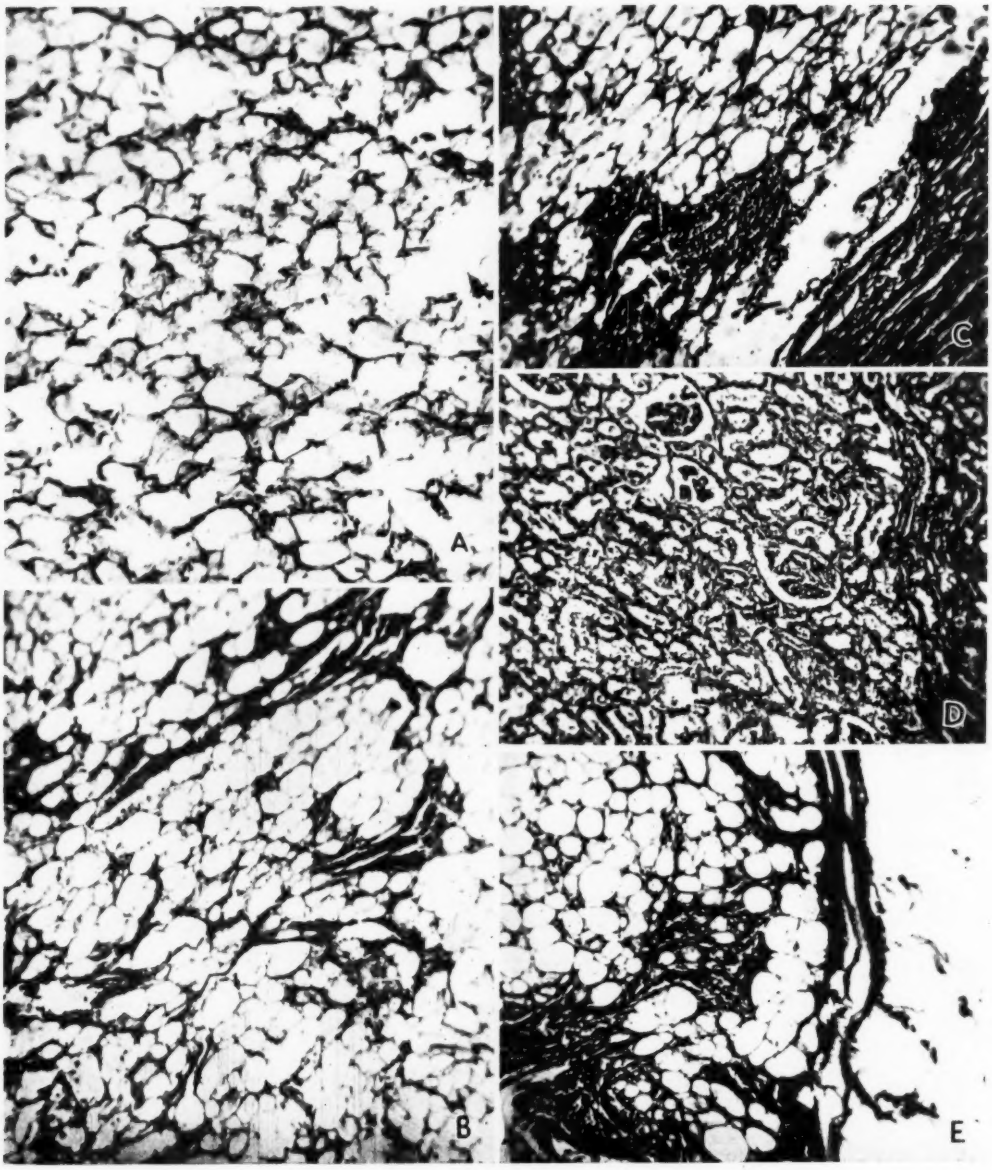

Figure 3. Photomicrographs of lipoma of kidney (×110). *A*, Section from center of growth. Note scarcity of fibrous tissue. *B*, Section from peripheral portion of growth. Fibrous tissue more pronounced. *C*, Section from margin of growth. No true capsule; the tumor being surrounded by compressed renal tubules. *D*, Section from portion of kidney not involved by growth (one pole). Note diffuse degeneration. *E*, Section from area where growth is in apposition to true renal capsule, suggesting possibility that growth arose from the capsule.

TABLE I.—PATHOLOGICAL CHART OF REPORTED CASES OF MASSIVE LIPOMA OF THE KIDNEY

Author	Treatment	Size	Type of tissue	Number	Position	Capsule
Warthin	Nephrectomy	Large (14 by 8 by 6 inches)	Fibrolipoma. No adrenal tissue. Numerous blood vessels. No hæmorrhage or pigment deposit	Single	Between cortex and medulla	None
Grawitz		Large (23 by 19 by 12 centimeters)	Angiomyolipoma. Areas of angiomatous (arterial) nature; some of smooth muscle, mostly lipomatous.	Single	From hilus to cortex. Poles left free	Fibrous Compression of kidney tissue around it
Bartsch		Large. With kidney measured 25 by 19 by 12 centimeters	Myolipoma. Smooth muscle tissue and lipomatous tissue	Single	Not definitely stated	Not definitely stated
Alsberg	Nephrectomy	Size of a millet seed to that of a walnut	Fibrolipomata. Some lipomatous. Some fibrous. Some mixed (lipomatous). 1 adrenal rest found	Multiple	Scattered evenly throughout cortex and medulla	
Keenan and Archibald	Nephrectomy	Large (one) Small (one)	Adenolipoma Mainly fat. Scattered, thick walled blood vessels surrounded by young fibrous tissue. Parenchymal cells, containing fat cells	Multiple	Under capsule in middle of kidney. It divided kidney both ways	Well marked off but no definite capsule
Lower and Belcher	Nephrectomy	Large (15 by 11 by 8 centimeters)	Fibrolipoma	Single	Under capsule in middle of kidney. It divided kidney both ways	Well marked off but no definite capsule

TABLE II.—CLINICAL CHART OF REPORTED CASES OF MASSIVE LIPOMA OF THE KIDNEY TREATED SURGICALLY

Author	Age	Side	Sex	Symptoms	Associated diagnosis	Postoperative course
Alsberg	40	Right	F	Symptoms of inflammation of abdomen for 10 years. Pale. Much loss in weight	Questionable	Well 2 years after operation
Warthin	31	Left	F	Difficulty in childbirth. Tumor mass; abortions	No statement	Cured?
Keenan and Archibald	Adult age?	Right	F	Attacks of dull pain in right side. Lump in right side	None	Well 2 years after operation
Lower and Belcher	52	Left	F	Indigestion. Pain in epigastrium. Constipation	Parkinsonian syndrome	Well 8 months after operation

The growth can be diagnosed only by examination of the tissue but in our case the tumor was thought to be malignant even after the kidney had been removed; and its true character was established only by the pathological report. The diagnosis of tumor in our case was established by the pyelogram.

TREATMENT

The only treatment is the removal of the tumor by nephrectomy, which should be followed by X-ray therapy.

PROGNOSIS

These tumors are very prone to recur. At each recurrence the tumor is more cellular in type than its predecessor and ultimately the tumor assumes sarcomatous characteristics.

SUMMARY AND CONCLUSIONS

1. A sixth case of massive lipoma (fibrolipoma) of the kidney has been presented, the fourth one to be removed by nephrectomy.

2. The characteristic features of this case are apparently identical with those of the one reported by Warthin.

3. In this case the principal symptoms were apparently referable to the gastro-intestinal tract. In general the symptoms in these cases are mild and similar to those presented by any tumor of the kidney.

4. This case, like all other reported cases, was in a woman of middle age.

5. The pyelogram showed definitely a deformity of the kidney pelvis.

6. Lipoma of the kidney is probably less malignant than has generally been supposed.

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SUTURE OF THE FACIAL NERVE WITHIN THE TEMPORAL BONE

With a Report of the First Successful Case

By STERLING BUNNELL, M.D., San Francisco

ALTHOUGH the facial nerve has frequently been severed in the course of operations for mastoiditis, its repair by direct suture in the region of the middle ear has not yet been reported. Because of the technical difficulty of suturing such a tiny nerve so deep in the bone, other methods have been adopted such as anastomosis with the eleventh and twelfth nerves or facial plastics. These methods robbed the tongue or shoulder of some function and though they restored some voluntary expression they failed to restore emotional expression.

HISTORY

In 1898 Faure at the suggestion of Furet first joined the proximal end of the eleventh nerve to the distal end of the seventh nerve. The operation was repeated by Kennedy in 1899 and Cushing in 1902.

In 1900 Mannasse first did it on dogs and obtained faradic response; and Kennedy in 1911 using the eleventh and twelfth nerves in dogs and monkeys, noted some degree of motor return and decrease in asymmetry.

Korte, in 1901, was the first to anastomose the twelfth and the seventh; he reported the results in 1903. In that year Ballance reported anastomosis of the eleventh and seventh, which gave associated movements only.

In 1910 Grant reported joining the eleventh nerve to the seventh and stated that he prevented atrophy of the trapezius or weakness of the shoulder by joining the descendens hypoglossi to the distal end of the eleventh nerve.

In 1913 Ballance repeated this joining the twelfth to the seventh nerve and joining the descendens hypoglossi to the distal end of the hypoglossal nerve to prevent atrophy of the tongue.

Eden in 1911 advised transplanting a strip of masseter muscle to the angle of the mouth and one of the temporal muscle to the angle of the eye.

Since then many operators have used the eleventh or twelfth nerves to anastomose to the distal end of the facial and it has become customary to join the proximal end of the descendens hypoglossi to the distal end of the eleventh or twelfth to preserve the tone of the trapezius or tongue respectively.

RESULTS AFTER SPINOFACIAL AND HYPOGLOSSOFACIAL ANASTOMOSES

The symptoms of facial paralysis have been aptly described as follows: "The eye cannot close and constantly weeps. The mouth dribbles, the speech is interfered with, and mastication is impaired. The delicate shades of continence are lost. Joy, happiness, sorrow, shock, surprise, all the emotions have for their common expression the same blank stare."

Anastomoses of the eleventh or twelfth nerves into the facial nerve will restore tone and voluntary movement to the paralyzed side of the face and also symmetry if the face is kept at rest, but not when under emotion. They are attended, however, by atrophy, loss of function and associated movements and do not restore emotional facial expression.

Severance of the spinal accessory nerve is followed by atrophy of the trapezius muscle, a high position of the scapula and some impairment of free and forceful movements in elevating the arm and shoulder. Loss of the hypoglossal nerve causes atrophy of half the tongue and a varying amount of interference with articulation, mastication, and swallowing.

Associated movements always result from these anastomoses and persist permanently unless re-education is successful. Stookey reports a case 10 years after a spinofacial union in which associated movements and no others existed. The patient could not close

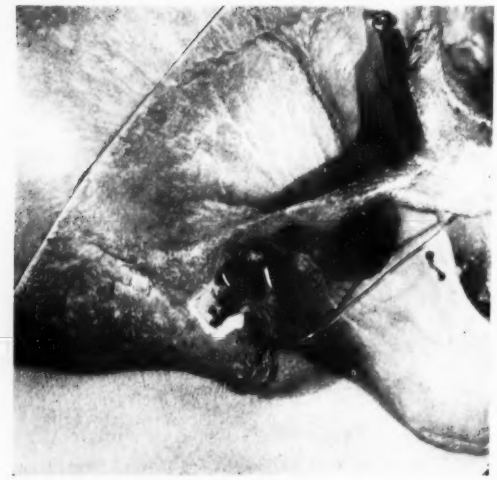


Fig. 1. Showing how the facial nerve as represented by a wire pursues a course around a right angle as it emerges from the stylomastoid foramen and how 8 millimeters in length can be gained by chiseling away the vaginal process so the nerve can run in the hypothenuse of the right angled triangle, and thus run in a straight line from the parotid gland to the middle ear. The nerve was sutured in the middle ear where the tip of the wire shows.

his eye without raising his shoulder or turning his head. In many cases reported facial grimaces occur when the shoulder is moved and in glossofacial cases the facial contortions accompanying mastication lead to embarrassing situations. Some of the patients who had skill and perseverance have re-educated themselves so that these associated movements were repressed and they could make voluntary movements of that side of the face and imitate to some degree facial expression. This, however, is voluntary and not emotional facial expression. C. C. Coleman states: "The response of the muscles to emotional stimulus gives prominence to the deformity so that rigid repression of all facial movement is likely to become a fixed habit." Adson writes: "From this review of the literature it is evident that the spinofacial or the faciohypoglossal anastomoses do not offer all that is hoped for in the restoration of facial control. It is true that regeneration takes place, that facial tone returns and that voluntary movements can again be performed, but it is also true that the patient has difficulty in expressing emotion on the side that was paralyzed and that disassociated movements of the face occur when the shoulder or tongue is moved."

It might be thought that re-education is more apt to follow when the twelfth nerve is used rather than the eleventh, as the cortical and medullary centers and the peripheral distribution are closer to those of the seventh, but clinically this has not been marked. Re-education has been as great after spinofacial anastomoses. Not as yet has emotional expression come as cortical centers have not been known to change in this. Twelfth nerve fibers will continue to functionate as twelfth nerve fibers, even though growing down the seventh nerve. Theoretically emotional expression may develop after anastomosis has been done in infants by changing the function of the brain centers, but our cases are usually adults.

Direct suture of the facial nerve brings emotional facial expression naturally and has not the disadvantages of atrophy and loss of function and associated movements. Although the operation is technically difficult, there is in the attempt nothing to lose and all to gain.

INDICATIONS FOR OPERATION

Of the various facial palsies there is much in the selection of a suitable case. Fortunately it is usually possible to diagnose the site at which the facial nerve is interrupted. As the nerve has not as yet been successfully sutured as far proximal as the geniculate ganglion, we can exclude cases showing symptoms arising from lesions proximal to this point.

Lesions within the skull are suggested when the upper facial is spared, and there is involvement of the sixth nerve, the pyramids or fillet, or the association of lesions of the sixth to the twe fth cranial nerves of that side.

Suppression of lachrymal secretion and herpes of the auricle suggest involvement of the geniculate, while diminution of saliva without loss of taste, tinnitus, nerve deafness, and changes in equilibrium, a lesion proximal to it.

Suitable cases should be free from these symptoms and should show in addition to

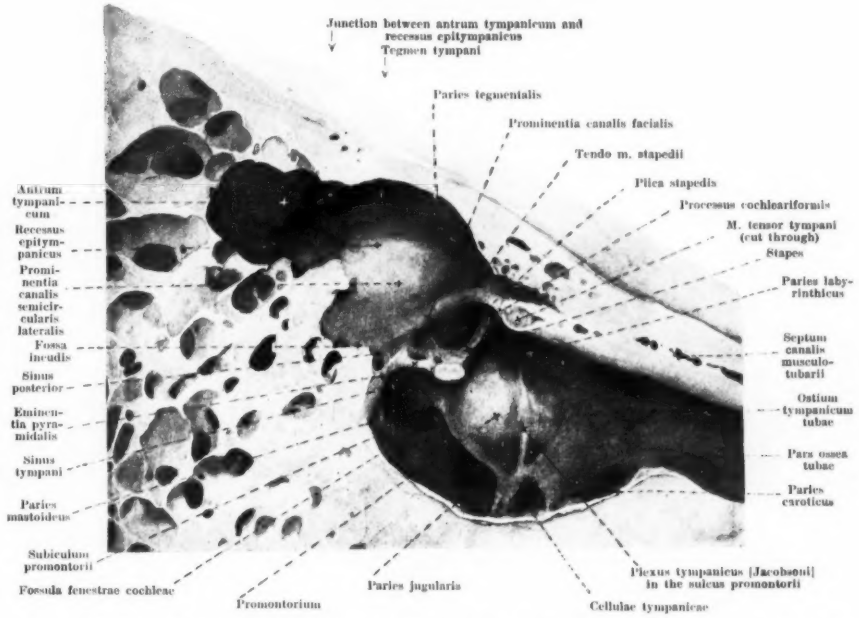


Fig. 2. Medial wall of the right tympanic cavity, lateral view, showing the prominence of the facial canal. (After Spalteholz.)

complete facial paralysis, loss of taste over the anterior two-thirds of one side of the tongue, diminished saliva on that side from involvement of the chorda tympani, and hyperacusis from involvement of the nerve to the stapedius.

If the paralysis comes at once after the mastoid operation, the nerve was probably severed and in the facial canal in its vertical portion at the level of the middle ear. Several months after all inflammation has cleared in such a case it is worth while to attempt a direct suture of the nerve. Paralysis which precedes the mastoid operation or follows it by 24 hours or more, is probably due to nerve injury by inflammatory swelling in the unyielding facial canal. These cases usually recover in a few weeks or months, or at most, in a year. In case the function of the nerve does not recover spontaneously it is possible that not too great a length of the nerve has been destroyed and that healthy nerve ends can be approximated and sutured. It is also possible that some cases of Bell's palsy can be repaired. If in a year there are no signs of recovery, spontaneous cure is hopeless. The damage is evidently necrosis from the ischæmia caused by swelling of neuritis in an unyielding canal. As the chorda tympani usually escapes and, in those where the chorda is taken, the nerve to the stapedius is usually spared, it is likely that the length of the portion of the nerve injured is short and located low in the vertical part of the canal. This is naturally the part most affected by exposure to cold.

REPORT OF FIRST SUCCESSFUL CASE

F. L., age 29, rancher, married, was examined January 3, 1925. Four months ago he was operated on for subacute mastoiditis on the right side. Complete facial paralysis was noted by his surgeon immediately following the operation and it persisted in typical form.

Operation was performed April 3, 1925, at St. Francis Hospital, San Francisco, California.

After the old mastoid scar had been excised and the bony region exposed, the

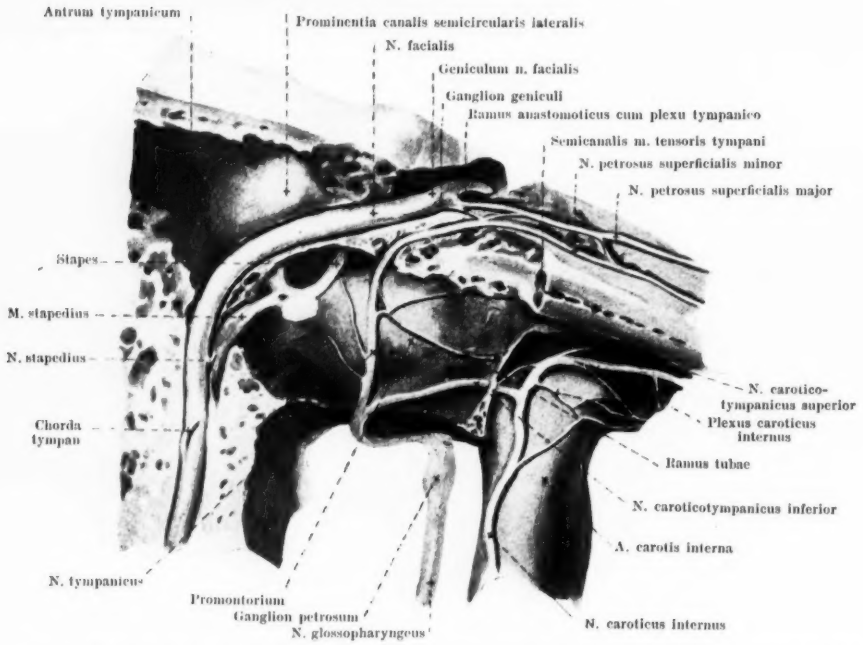


Fig. 3. Right facial nerve as it lies in the facial canal. The nerve was sutured just posterior to the stapes. (After Spalteholz.)

incision was prolonged down a crease in the neck for 2 inches. The ear and soft parts of the meatus were drawn forward and the remains of the meatal wall exposed. The mastoid region was chiseled, which enlarged and widened the excavation until the middle ear and lateral sinus were in view. The latter had been exposed at the former operation, and adherent to the lateral sinus and directed backward was found the neuroma of the proximal end of the facial nerve. It terminated 6 millimeters down from the bend of the facial canal. The severance therefore was just posterior to the pyramidal eminence on a level with the center of the posterior wall of the middle ear. As the facial canal was laid open to as far forward as the genu, care was taken not to injure the lateral semicircular canal, which prominence is just posterior and superior to the nerve. From the geniculate ganglion at the genu the facial canal, which has walls of firm bone, passes backward, downward and outward, forming the prominence of the facial canal, bends around the vestibular fenestra and pyramidal eminence and passes vertically downward through the thick bone of the mastoid process to the stylomastoid foramen. The front edge of the mastoid process and the vaginal process which runs from the mastoid to the styloid process were chiseled away until the full length of the vertical portion of the facial canal was laid open. The distal end of the facial nerve was found to be slightly attenuated and densely adherent in the facial canal 5 millimeters below the point where the proximal neuroma ended. With a probe the nerve branches were freed somewhat as they entered the parotid gland. This gained a few millimeters in length. The branches to the stylohyoid and posterior belly of the digastric muscles were still holding the nerve, so these were sacrificed. Four millimeters of the neuroma were removed and some from the distal end of the nerve until good nerve bundles were reached in each nerve end.

Fig. 4. Fig. 5. Fig. 6. Fig. 7.

Fig. 4. Photograph taken 17 months after suture of right facial nerve. Tone has returned to the facial muscles, restoring the symmetry of the face at rest.

Fig. 5. Photograph taken 17 months after suture in the middle ear of the right facial nerve to show the degree of voluntary motion of the right side of the face.

Fig. 6. Photograph taken 17 months after suture of the facial nerve, to show both sides of the face in symmetrical voluntary contraction.

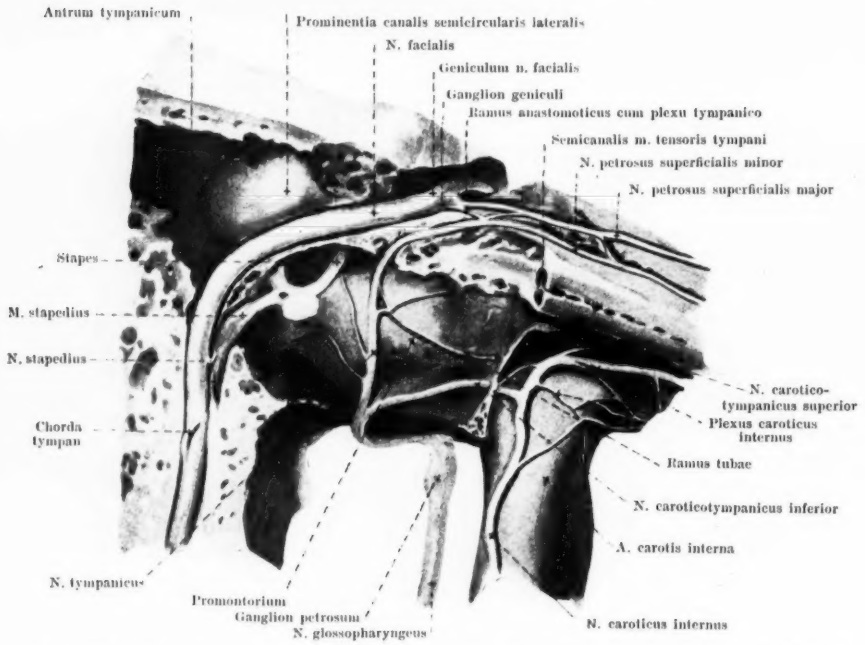
Fig. 7. Photograph taken 17 months after suture of the right facial nerve, showing that emotional facial expression is restored.

If the vaginal process of bone had not been chiseled away, the nerve ends could not have been approximated. The facial nerve turns a right angle as it enters the stylomastoid foramen, so that by chiseling away the vaginal process the nerve can be transplanted as the hypothenuse of the triangle in a straight line from the parotid gland to the middle ear. This gained for us 8 millimeters, so that the nerve ends could easily be approximated without tension. Opening and shutting the jaw did not increase the tension on the nerve, but drawing the jaw forward pulled the nerve 2 millimeters. The posterior wall of the facial canal was chiseled away as deeply as to the level of the nerve to facilitate the needle work. Adrenalin and wax were of service in obtaining a dry field.

The suturing of these tiny nerve ends in such a deep and awkward place was difficult. From the level of the surface of the skull the nerve ends were 7/8 inch deep and the soft parts still further deepened the pit. The nerve ends were sutured together by 4 sutures of finest silk placed through their sheaths by tiny curved eye needles. The usual straight needle could not be used. In repairing over 100 nerves in the hand and fingers some practice in suturing very small nerves had already been gained and this made the present suturing possible. I would strongly advise, however, that an operator first perfect himself in suturing small nerves (obtainable at a meat market) before attempting the present operation.

A pedicle strip 2¼ inches long of the surface of the sternomastoid muscle was turned up and used to cover the nerve suture and to fill the concavity, and the wound was closed.

Fig. 8. Photograph taken 14 months after suturing of the right facial nerve, showing that emotional facial expression is restored.



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COMMENT

If it be found impossible to approximate the nerve ends, a short free graft from the sural nerve of the leg can be used with good chances for success if the approximation is very accurate. If one does not succeed in suturing or grafting, no harm is done by the operation and resort may be had to one of the anastomosing methods.

Since performing the above operation, in reviewing the literature, I found that Dr. K. W. Ney described in 1922 an operation similar to the above as a possibility, but had never performed it.

REGENERATION OF THE NERVE

Six months after operation. The patient noticed the first signs of improvement. Previous to this time the right eye burned and his wife stated that it remained open in sleep. From now on the eye remained closed in sleep and the burning stopped. Up to this time the right side of the lips felt stiff and he could not say such labio-dentals as "55." The stiffness left and he could pronounce "55." He ceased using adhesive plaster on the face to keep the paralyzed muscles in relaxation. When shaving, until the present time he noticed a tickling in the right cheek which ran to the helix of the ear. This has now left. Touch still causes a tickling about the right side of the lips and chin. His face never had loss of sensation but the right side had felt stiff and tingled when touched.

Eight months after operation. The upper facial is not yet active. He has now seven wrinkles that come voluntarily under the right eye and three at the side of the mouth. He can now voluntarily produce the naso-labial fold and also one further posteriorly and below it. Food still catches in the right buccal pouch but less so than before.

Nine months after operation. Speech still improving. He easily pronounces "55." Food has ceased catching in the buccal pouch.

Eleven months after operation. Up to this time tears ran down the cheek from the right eye every few minutes; now they scarcely do so. Speech has improved considerably more.

Thirteen months after operation. He first whistled both by the lip and the tongue methods.

Fourteen months after operation. The tickle elicited by touching the right side of the face is now almost gone. When a spot an inch in front of the ear is touched he feels it in the helix (crossed axones). There is now good voluntary action of all of the muscles of the face including the platysma but with the exception of the frontalis. He can produce deep nasolabial folds on the right side, purse his lips, puff out the cheeks, and blow without puffing out the right cheek. The right eye can voluntarily close tightly making many wrinkles. It remains closed in sleep and tears do not run over. The speech is now without defect. Taste is still absent in the anterior two-thirds of the tongue on the right side, but is not expected to return as the chorda tympani was not repaired. Emotional expression has returned to the face and in the correct distribution.

Seventeen months after operation. The face when at rest is symmetrical. The facial muscles work more easily and quickly and independently in each part of the face. The face feels natural and has no more wooden or tense feeling. He chews on both sides of the mouth and food never catches in the buccal pouch. He holds a cigarette well on the right side. There is no abnormality in swallowing or in the tear or salivary functions and no difficulty in speech. The frontalis muscle, which is the last to recover, now shows slight voluntary motion and has normal and quick electrical reactions. Emotional expressions play over the face freely in a natural manner and with correct distribution in the various parts of the face.

ACUTE INFECTIONS OF THE LOWER ABDOMEN[1]

By D. P. D. WILKIE, M.D., M.Ch., F.R.C.S. (Eng. and Edin.), F.R.S. (Edin.), F.A.C.S. (Hon.),
Edinburgh, Scotland
Professor of Surgery in Edinburgh University

THE difficulties of diagnosis in appendicitis, I believe, are due largely to a failure of many to appreciate the fundamental facts of the pathology of acute appendicular disease. Until we realize that there are two separate and essentially different acute diseases of the appendix—the one acute inflammation of its wall, the other acute obstruction of its lumen, each with its own pathology and its peculiar clinical picture, we shall continue in greater or less confusion in interpreting the clinical manifestations in different cases.

ACUTE APPENDICITIS

An acute infection of the wall of the appendix is of common occurrence and gives rise to symptoms, constitutional in type, such as might be anticipated in a lesion primarily infective—thus malaise, loss of appetite, rise of temperature and pulse rate, coated tongue, epigastric discomfort, often amounting to pain, sometimes vomiting, and later some rigidity and tenderness in the right iliac fossa. The milder degrees of such disease must often come and go without the physician being called on either for diagnosis or treatment. The scarred, stenosed, and fibrosed appendices so often found are witness to such past and possibly forgotten attacks. Progressive inflammation may result, however, and when an early diagnosis is made, prompt operative interference is the wisest course.

ACUTE APPENDICULAR OBSTRUCTION

For this disease a preceding attack of inflammation is usually responsible. A stenosis near the proximal end of the appendix has compromised the free ingress and egress of fæcal matter. A portion of retained fæcal content hardens to form a concretion, and then at some time, usually without warning, the peristaltic action of the appendix drives the concretion into the narrow stenosed area and there impacts it. The appendix is now completely obstructed, with what result? This question can be answered most simply by reference to animal experiment. If one ligates the appendix of a rabbit at its proximal end, leaving the meso-appendix with blood supply intact, one finds that the sequel depends entirely on the content of the appendix at the time of obstruction. If the appendix was empty, a mucocele slowly develops, with no apparent disturbance of the animal's health (Fig. 1). If a small amount of fæcal matter was contained within the appendix, the latter becomes distended with pus, and an empyema of the appendix results (Fig. 2). If a considerable amount of fæcal matter is pressed from the cæcum into the appendix before the ligature is applied, the animal is always dead within 24 hours from a gangrenous perforated appendix (Fig. 3). An isolated loop of ileum in the cat behaves similarly under the same conditions (3).

Exactly the same sequel of pathological changes occurs in the human subject when the appendix becomes obstructed, the degree of pathology depending on the amount of fæcal content at the moment of obstruction (Fig. 4).

Clinical picture in acute appendicular obstruction. The patient is suddenly seized with acute cramp-like pain in the epigastric region, just above the umbilicus, and vomits. The pain gradually subsides but returns in spasms, usually with repeated vomiting. Frequently the attack starts during the night, and for the first 6 to 8 hours there may be *no rise of pulse or temperature*, even though the appendix may by this time be well on the way to gangrene. The patient usually looks ill and realizes that something is seriously amiss in his abdomen. There is almost always some tenderness and rigidity in the right lower quadrant.

Such a case should be treated with the *promptitude and immediacy of an intestinal*

[1]Read before the Clinical Congress of the American College of Surgeons, Montreal, October, 1926.

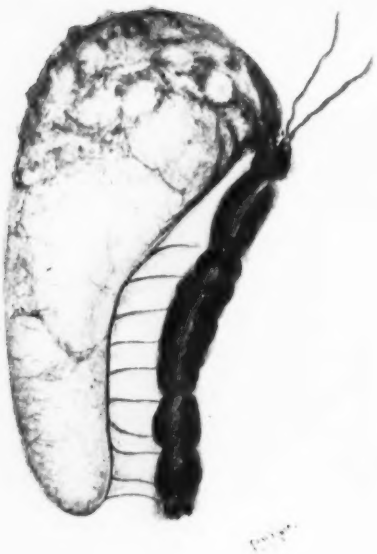

Fig. 1.

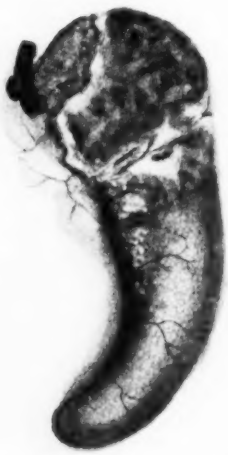

Fig. 2.

Fig. 3.

Fig. 1. Experimental appendicular obstruction in the rabbit. Mucocele of appendix. Animal in good health killed 21 days after ligature of proximal end of empty appendix.

Fig. 2. Experimental appendicular obstruction in the rabbit. Empyema of appendix 10 days after ligature of proximal end of appendix containing small quantity of fæcal matter.

Fig. 3. Experimental appendicular obstruction in the rabbit. Gangrene and perforation of appendix, with death 24 hours after ligature of proximal end of appendix containing much fæcal matter.

obstruction, which it really is; otherwise perforation into the free peritoneal cavity will result in the evacuation of the pent-up decomposing fæcal matter, with disastrous consequences. Immediate operation with a free abdominal incision, so that the distended appendix may be freely exposed to view, delivered and removed without rupture, is the only rational treatment. If the appendix is removed without perforation, even though it be gangrenous, no peritoneal drainage is necessary.

Expectant treatment in acute infections. There can now be no doubt that when acute disease of the appendix is diagnosed in its early stages, immediate operation should be carried out. This is the only safe rule for general application. When a case of appendicitis is not seen or is not recognized until the fourth day, however, the question of operation is a much more difficult one to decide. If there be general distention or if a firm inflammatory mass be felt and there is no definite evidence of a considerable collection of pus, if the patient's general condition is fairly good and the pulse below 110, it is wiser to treat on expectant lines with morphia, hot fomentations, and proctoclysis. If a localized abscess develops, this may be evacuated. The great majority of these patients who have successfully weathered the peritoneal storm for 4 days will recover. A meddlesome operation will precipitate a goodly number of them into a critical condition which may terminate with death. A good rule is to ask oneself in the early cases whether there is any good reason why one should not pursue the safe course and operate, and in the late cases in reasonably good condition whether one is justified in interrupting the natural process of cure which is by that time well established. To operate on all cases at once, no matter at what stage they are recognized, is to allow reason to be overruled by prejudice.

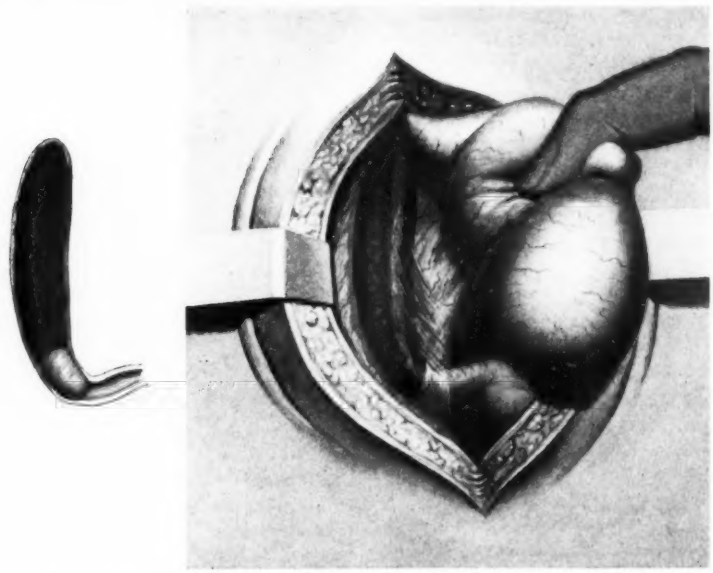

Fig. 4. Acute appendicular obstruction. Retrocæcal appendix exposed 16 hours after onset of symptoms. Inset shows appendix opened, concretion impacted at angle. Decomposing fluid fæcal matter filled distended and gangrenous distal portion.

Two other groups of cases are, I believe, best treated on expectant lines, namely, the peritonitis associated with acute gonococcal salpingitis and that associated with acute diverticulitis of the pelvic colon, the latter usually in stout individuals. Unless a definite abscess be present, no help is given by operation in such cases.

DRAINAGE IN LOWER ABDOMINAL INFECTIONS

There has been at all times a tendency to standardize our treatment of abdominal infections. Thus a period of peritoneal lavage was succeeded by an era of dry surgery; the fashion of free and multiple drainage was followed by a swing back to no drainage at all. I would appeal for destandardization in our treatment of such infections. Prejudice in favor of one particular line of treatment in all cases can only reduce the chances of recovery in some cases. While the remarkable recuperative power of the undamaged peritoneum may be trusted to deal with all moderate infections, provided no gross foreign matter is left within it, it is equally true that where ragged and especially oozing surfaces are laid bare, a drain to the damaged area is logical and helpful surgery.

ABDOMINAL WALL INFECTION

In many cases in which a gangrenous or a perforated appendix has been removed, a drain inserted, and the abdominal wall stitched up, the first few days after operation are marked by considerable constitutional disturbance which clears up about the fourth day, when some fœtid discharge escapes alongside the drain. This discharge comes not from the peritoneal cavity but from the abdominal wall. This sequence of events is most marked in stout subjects.

The abdominal wall is much less capable of dealing with infection than is the peritoneum, and it is peculiarly susceptible to the attack of anaerobic organisms, especially when non-vital tissue in the form of buried sutures is present. A much smoother postoperative course is ensured in such cases by bringing the peritoneum and muscular tissues lightly

together by silk-worm gut sutures, the ends of which are brought out at the same side of the wound and tied over a piece of rubber tubing or through a button, and the wound in the skin and subcutaneous fat left wide open and packed with gauze. If a Carrel tube is inserted under the gauze, peroxide of hydrogen may be injected from time to time, and the eventual removal of the gauze at the end of 4 days rendered easy and painless. The wound is then strapped, and healing in the end is more rapid and complete than in the wound primarily closed, where suppuration with sloughing of aponeurosis is so apt to occur.

CÆCOSTOMY IN ACUTE INFECTIONS

It is common knowledge that the development of a fæcal fistula in a bad peritonitis case following appendicectomy is frequently followed by an immediate improvement in the general condition of the patient. Of late years I have been impressed by the comfort and benefit given by performing a valvular tube-cæcostomy in late cases of appendicitis in which a distended cæcum is a feature. Such a valvular opening does not delay convalescence and saves much suffering and distention during the early postoperative period.

JEJUNOSTOMY IN THE OBSTRUCTION OF PERITONITIS

A postmortem study of cases dying of so-called peritonitis 5 to 10 days after operation for acute appendicitis convinced me that intestinal obstruction accounted for death in quite 75 per cent of cases. That quite recent lymph adhesions may cause a fatal small intestinal obstruction was readily demonstrated by experiment (4).

Victor Bonney (1) emphasized the value of jejunostomy in these cases, and Sampson Handley (2), in his paper on ileus duplex, re-affirmed and extended those observations. The presence of colicky pain with distention some days after the primary operation is the indication for jejunostomy, which must be done sufficiently high to drain the upper jejunal loops, where the toxic content lies. If performed by a valvular method and through the omentum, as recommended by C. H. Mayo, it need leave no fistula and is a truly life-saving operation.

In conclusion I would appeal for an open mind in dealing with lower abdominal infections, a problem with such diverse manifestations and complications that no standardized methods can meet all contingencies. Let us regard each case as a problem in itself to be dealt with under the dictates of sound surgical principles.

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EXCISION OF ULCER OF THE DUODENUM[1]

By E. STARR JUDD, M.D., F.A.C.S., and GUNTHER W. NAGEL, M.D., Rochester, Minnesota
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THE operation for excising ulcers of the duodenum has not gained in popularity to any great extent for two reasons: first, the results of gastro-enterostomy when performed for this condition have usually been satisfactory, and second, unless the first portion of the duodenum is free and mobile, excision of an ulcer is technically very difficult. Unless it is possible to excise the ulcer with just as little risk and as good a prospect of satisfactory results as attends gastro-enterostomy, then there is no occasion for excision. The ideal operation for any condition is one that removes the lesion causing the trouble with the minimum of disturbance and leaves the least possible chance of recurrence.

If it were not for the occurrence of secondary ulcers in the jejunum in some cases after gastro-enterostomy, the results of this operation in cases of duodenal ulcer would be almost perfect. Jejunal ulcer does not occur as often following gastrojejunostomy as some are trying to make us believe but it does form at times. It is impossible at present to estimate how frequently it occurs or to specify the type of case in which it is liable to develop. The most interesting phase of the problem is that certain persons seem to have a predisposition toward ulcer and that in such persons ulcer will form repeatedly in spite of the eradication of all foci of infection and notwithstanding the most rigid management and dietary precautions from the time of the operation.

It was a case of this kind that aroused our interest in the possibility of elaborating some procedure by which the ulcer could be removed and gastrojejunostomy avoided. The patient was a young man who for many years had had symptoms suggesting duodenal ulcer. He had had several courses of treatment by the late Dr. Sippy, and on each occasion had been completely relieved of all of his symptoms during the time that he was under treatment. They recurred, however, as soon as he varied the routine. The nature of his business made it very difficult for him to follow the plan laid down for him. He prepared for operation with the hope of being completely and permanently relieved of all of his symptoms. At operation gastro-enterostomy was performed for a small ulcer found on the anterior surface of the duodenum. Shortly afterward symptoms recommenced in spite of the rigid dietary regimen that he had maintained. Four weeks later an ulcer at the stoma was observed under the roentgen-ray. At the second operation the ulcer was excised and the stoma enlarged. The patient was advised to continue the rigid management that had originally kept him free from symptoms. After 3 months the resumption of a regular diet precipitated an immediate return of the symptoms. The roentgen-ray showed deformity of the stoma characteristic of jejunal ulcer. The patient returned willing to try further operative work. At the third operation the gastro-enteric anastomosis was taken down and a small ulcer of the duodenum excised. Complete relief of symptoms followed. This indicated to us that simple excision of the small ulcer in the first place would have saved him the other two operations. This happened about 14 years ago and since then we have excised all ulcers of the duodenum when it seemed possible to do so.

The method of operating which we now use has been evolved from earlier methods. In the earlier cases we simply excised the ulcer and closed the opening in the duodenum so as not to interfere with the intestinal lumen. In no instance did we attempt a plastic operation on the pylorus. In some of these cases the symptoms were not completely relieved, but the ulcer did not recur. We then extended the operation by dividing the pyloric sphincter after excising the ulcer. The ultimate results in these cases were the same as in those in which nothing had been done to the pylorus but, because of the larger opening on the

[1] Read before the Western Surgical Association, Duluth, October 14, 1926.

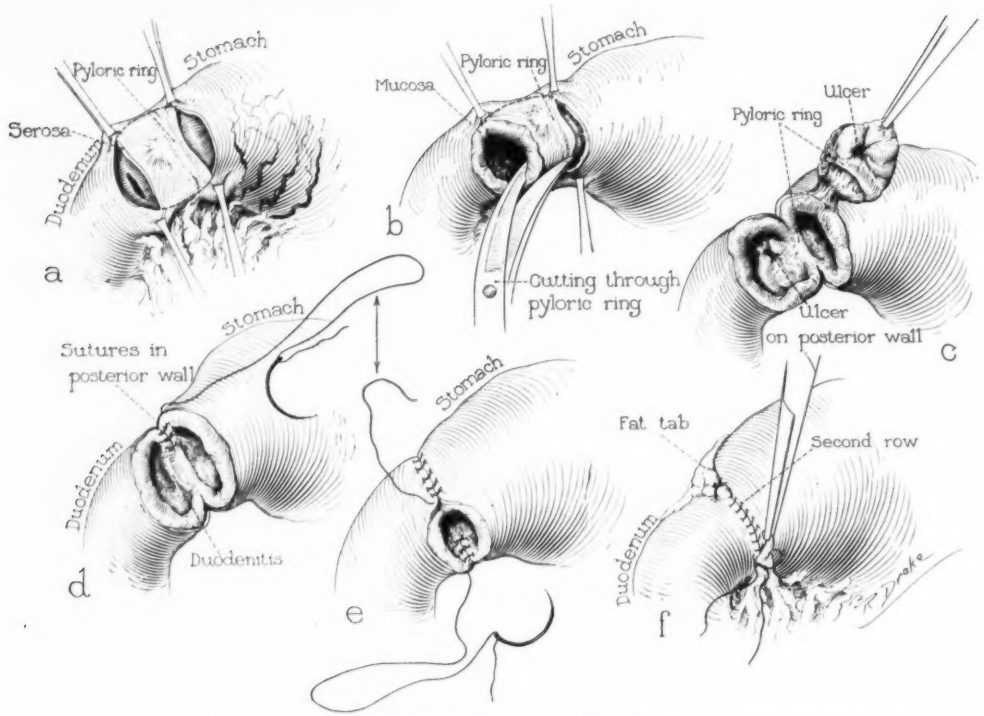

Fig. 1. Excision of duodenal ulcer, partial resection of pyloric sphincter and gastroduodenostomy.

stomach side, the operation was technically easier to perform. Certain of the symptoms in cases of ulcer are the result of tension and spasm due to the action of the sphincter. It would seem advisable in all operations for ulcer to perform some operation that would permanently do away with the activity of the sphincter. Plastic procedures such as dividing and suturing in opposite directions do not seem to abolish the sphincter action for any length of time. Following most plastic operations which include division of the sphincter there is still a sphincter action. It may be slight at first but after complete healing it is usually just as active as before the plastic operation. We believe that this condition is the cause of the high percentage of unsatisfactory results following plastic operations on the pylorus.

Apparently the only method of destroying sphincter activity at the pylorus is to remove all or part of the muscle. Removal of all of the muscle necessitates complete pylorectomy. This seems a more formidable operation than is warranted in cases of simple duodenal ulcer, and moreover, it may be followed by scar and contracture interfering with the lumen. A much more conservative and simple operation is the excision of the anterior half of the pyloric sphincter together with the cap of the duodenum and the ulcer (Fig. 1). In most cases the ulcer occurs in the cap of the duodenum and enough of the duodenum may be removed to justify classifying the operation as partial duodenectomy. When this portion of the duodenum has been removed and the anterior part of the sphincter excised, the two openings, one at the lower end of the stomach and the other at the upper end of the duodenum, stand out just as the two openings of a gastro-enterostomy after the posterior row of sutures has been put in. The technical steps

of the operation are not difficult so long as the tissues are well exposed; and exposure is readily carried out if the operation is not attempted in cases in which the ulcer is some distance from the pylorus or in which the duodenum is too firmly fixed to be readily mobilized.

MULTIPLE ULCERS

It is likely that single ulcers do occur but it is probable that in most instances more than one ulcer is present in the duodenum. Many times we have been able to demonstrate several ulcers in a small piece of tissue excised. However, we have often found areas of duodenitis without being able to demonstrate any true ulceration. Since we have been excising the affected portion of duodenum in cases of this kind, we have had a better opportunity to study the surgical pathology of the duodenum and have been especially impressed by the number of cases in which more than one ulcer is found, by the frequency with which duodenitis is encountered and by the constant association of ulcer and an area of duodenitis on the posterior surface in the mucous membrane, about 1 centimeter below the pylorus. Often an ulcer occurs in this situation, but many times there is no demonstrable ulcer but a congested, easily-bleeding mucous membrane. More than 95 per cent of all ulcers of the duodenum occur within two-thirds of an inch of the pylorus. If an ulcer is found on the posterior surface in addition to that in the anterior portion, it should be excised through the opening made by the removal of the cap (Fig. 2). It is often difficult to excise the posterior ulcer completely but it can be readily destroyed by the cautery or clipped out in pieces and this surface sutured over. We have often treated posterior ulcers in this manner and with very good results. If the posterior lesion is duodenitis, it is not necessary to do anything to it.

SPECIAL INDICATIONS FOR EXCISION AND PARTIAL DUODENECTOMY

We have not felt justified in performing the operation in all cases of duodenal ulcer so far, but have confined it to those in which hæmorrhage is a predominant symptom. Gastro-enterostomy is often followed by recurrence of

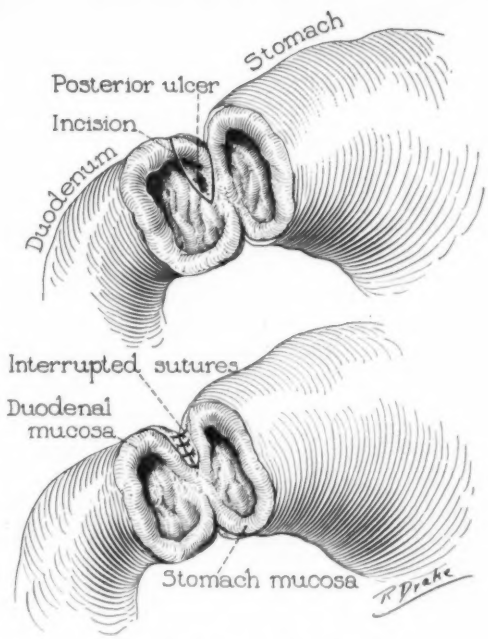

Fig. 2. Excision of posterior ulcer.

the bleeding. We prefer excision and partial duodenectomy when the patient is young, especially if the history is short. Many such patients can be cured by medical management but failure to respond demands operation. We believe this operation offers all that gastrojejunostomy does and the removal of the ulcer as well. Small ulcers may be overlooked and rarely new ulcers may form after the operation, but the ulcer will not recur as frequently as the jejunal ulcer occurs after gastro-enterostomy. The recurrence of an ulcer in the duodenum is not as serious a matter as a jejunal ulcer. Partial duodenectomy should be chosen in all cases in which it can be carried out with no greater risk than attends gastro-enterostomy.

LIMITATIONS OF THE OPERATION

So far we have not tried excision and partial duodenectomy when the duodenum is firmly fixed, but we are extending its application each year. The duodenum can be mobilized to an extent not realized until we actually try

it. We have not felt that this operation was indicated in cases in which, because of long standing inflammation, the entire upper portion of the duodenum was converted into a hard cord. In these cases there is great dilatation of the stomach and marked thickening of its wall and no good tissue in the duodenum with which to perform the technical steps of the operation.

Fixation of the duodenum and deformity resulting from long-standing trouble necessitate gastro-enterostomy in about half of the cases of duodenal ulcer, although the application of partial duodenectomy is being gradually extended. Apparently the tissues of this portion of the duodenum and the lower end of the stomach are not disturbed by the operation for there has not been a single technical failure in any of the cases in spite of the fact that in some cases sutures were placed with difficulty and under considerable tension. Healing has ensued without leakage in all cases.

RESULTS OF OPERATION

In attempting to estimate the results of this operation one must consider the question as to what will prevent the formation of other ulcers after the original ulcer has been excised. Until we know more about the etiology of these conditions this question will have to be answered by actual experience with cases. As the report of cases shows, there have been a few instances in which new ulcers formed or small ulcers were overlooked at the time of operation. If the ulcer is the result of an infectious process at a remote point, then prevention of recurrence of ulceration will depend on attention to all of these foci of infection. By isolating strains of organisms from tonsils and teeth in cases of duodenal ulcer and infecting the blood stream of animals with these organisms, a lesion of the duodenitis type can be produced in a rather high proportion of the animals. Organisms can be found in the tissues of experimentally produced ulcers. It seems that there has been considerable evidence presented recently which would tend to support the infection theory of the formation of ulcer. If on the other hand the ulcer is the result of some physiological disturbance, then some changes must be made which will affect physiological processes. The last series of cases, in which a considerable part of the sphincter was actually removed, have shown sufficient improvement in results to justify this procedure. A careful follow-up of all the cases indicates that recurrence of ulcer following this operation is rare.

At first we were very cautious in the application of the operation but the results were so uniformly good in the earlier cases that we have been led to perform it by preference in cases of duodenal ulcer. We have further demonstrated that it is possible to carry out the technique satisfactorily in many cases in which a few years ago we believed it was impossible.

TABLE 1.—CASES OF THE FIRST AND SECOND GROUPS (188)

		Years	Number
Men			109
Women			79
Oldest		66	
Youngest		17	
Average age		38	
Average duration of symptoms		9	
CASES OF FIRST GROUP, SPHINCTER NOT DISTURBED (140)			
History previous to operation			
Typical of duodenal ulcer			95
Typical, and other symptoms			27
Typical, and hæmorrhage			19
Not typical			18
Operations previously performed			
Appendectomy			16
Gastro-enterostomy			3
Gastro-enterostomy and appendectomy			8
Cholecystectomy, gastro-enterostomy and appendectomy			1
Excision of gastric ulcer and gastro-enterostomy			1
Appendectomy and pelvic operation			3
Miscellaneous operations			7
Examinations			
Roentgen-ray:	Duodenal ulcer		97
	Deformed cap		1
	Gastric and duodenal ulcer		1
	Gastrojejunal ulcer		1
	Indeterminate		5
	Obstruction (included in ulcers)		4
Gastric analysis (Groups 1 and 2):			
	Combined acids (average)		55
	Free acids (average)		40
Operation			
Excision of ulcer			25
Excision of ulcer and appendectomy			96
Excision of ulcer, appendectomy and cholecystectomy			6

	Per cent	Number
Excision of ulcer and cholecystectomy		2
Excision of ulcer and choledochotomy		1
Excision of ulcer, appendectomy, cholecystectomy and choledochotomy		1
Excision of ulcer and cholecystostomy		2
Excision of ulcer and gastro-enterostomy taken down		2
Excision of ulcer and gastro-enterostomy		1
Excision of ulcer, appendectomy and gastro-enterostomy		1
Excision of ulcer, appendectomy and excision of jejunal ulcer		1
Excision of ulcer, excision of jejunal ulcer and gastro-enterostomy		1
Excision of ulcer, appendectomy and cholecystostomy		1
(Contact ulcer was cauterized in 15 of the above cases).		
Lesion		
Duodenal ulcer		130
Duodenitis		10
Cholelithiasis		5
Gastrojejunal ulcer		2
Postoperative sequelæ		
Bronchitis		1
Bronchopneumonia		3
Infected wound		2
Phlebitis		1
Died[1]		2
Results from 4 months to 3 years after operation		
Patients heard from		108
Cured	57	62
Greatly benefited	10	11
Slightly benefited	13	14
Failure	19	21
Total number benefited	80	87
Examinations		
Roentgen-ray: Cap deformed		12
Duodenal ulcer		1
Duodenal ulcer with enlarged stomach		4
Negative		1
Gastric analysis:		
Combined acids (average)		51
Free acids (average)		33
Postoperative details		
One patient developed gall-stone colic several years after operation and the gall bladder was removed with relief of symptoms; the duodenum was normal in appearance at the time.		
Failures		
Operation for ulcer after 3 years; details not known		1
Gastro-enterostomy elsewhere 3 years later; complete relief after operation		1
Gastro-enterostomy elsewhere; complete relief after operation		1
Deaths		
One patient died 4 months after operation. Besides excision of ulcer the gall bladder containing stones was removed, and the common duct explored and drained, one stone being found in the ampulla. The immediate cause of death was acute nephritis. One patient died 7 months after operation. The home physician diagnosed cancer of the stomach. No details are available.		

[1] Both patients died from bronchopneumonia, one 14 days and one 11 days after operation. In one a gastrojejunal ulcer was excised; the other case was uncomplicated.

CASES OF SECOND GROUP, SPHINCTER CUT BUT NOT EXCISED (48)

	Per cent	Number
History previous to operation		
Typical of duodenal ulcer		40
Typical with other symptoms		7
Typical and hæmorrhage		3
Not typical		1
Operations previously performed		
Appendectomy		11
Gastro-enterostomy		1
Gastro-enterostomy and appendectomy		1
Appendectomy and pelvic operation		1
Perforating ulcer drained		1
Other operations		1
Examinations		
Roentgen-ray: Duodenal ulcer		38
Gastric and duodenal ulcer		2
Gastrojejunal ulcer		2
Indeterminate		1
Gastric analysis (Groups 1 and 2):		
Combined acids (average)		55
Free acids (average)		40
Operation		
Excision of ulcer		16
Excision of ulcer and appendectomy		25
Excision of ulcer and cholecystectomy		3
Excision of ulcer, appendectomy and cholecystectomy		1
Excision of ulcer and gastro-enterostomy taken down		1
Excision of ulcer, gastro-enterostomy taken down and excision of jejunal ulcer		1
Excision of ulcer, appendectomy and gastro-enterostomy		1
(Contact ulcer cauterized in 9 of the above cases).		
Lesion		
Duodenal ulcer		43
Duodenitis		5
Ulcer and duodenitis		8
Gastric and duodenal ulcer		2
Cholelithiasis		1
Gastrojejunal ulcer		1
Postoperative sequelae		
Bronchitis		1
Pleurisy		2
Infected wound		1
Secondary hæmorrhage		1
Pulmonary embolus and phlebitis		1
Died 10 days after operation from peritonitis (ulcer had been excised and gastro-enterostomy performed)		1
Results		
Patients heard from		30
Cured	53	16
Greatly benefited	20	6
Failure (one gastric resection elsewhere three years later)	27	8
Total number benefited	73	22
Examinations		
Roentgen-ray: Cap deformed		2
Duodenal ulcer		1
Duodenal ulcer with enlarged stomach		2
Gastric analysis:		
Combined acids		66
Free acids		47

TABLE II.—CASES OF THE THIRD GROUP (85)

	Years	Number
Men		50
Women		35
Oldest patient	67	
Youngest patient	18	
Average age	40	
History previous to operation		
Average duration of symptoms	12	
Typical of duodenal ulcer (12 with hæmorrhage)		71
Typical of duodenal ulcer with other symptoms		4
Not typical		10
Operations previously performed		
Appendectomy		20
Gastro-enterostomy		1
Appendectomy and cholecystectomy		2
Appendectomy and pelvic operation		1
Suture of perforating ulcer		1
Hernia		1
Examinations		
Roentgen-ray: Duodenal ulcer		77
Deformed cap		1
Gastric and duodenal ulcer		1
Obstruction		5
Gastric analysis:		
Combined acids (average)		69
Free acids (average)		47
Operation		
Gastroduodenostomy		20
Gastroduodenostomy and appendectomy		48
Gastroduodenostomy and cholecystectomy		9
Gastroduodenostomy, appendectomy and taking down gastro-enterostomy		1
Gastroduodenostomy, appendectomy and cholecystectomy		5
Gastroduodenostomy, appendectomy and cautery to contact ulcer		1
Gastroduodenostomy and knife excision of contact ulcer		1
Lesions		
Ulcers of anterior wall		69
Multiple ulcers		4
Ulcers of posterior wall		2
Contact ulcers		6
Gastric and duodenal ulcer		1
Duodenitis		12
Spastic pylorus		1
Cholelithiasis		3
Postoperative sequelæ		
Normal		79
Pneumonia		2
Pleurisy		1
Phlebitis		2
Died[1]		1
	Per cent	
Results from 6 months to 2 years after operation		
Patients heard from		58
Cured	60	35
Greatly benefited	16	9
Slightly benefited	16	9
Failure	7	4
Died		1
Total number benefited	92	53

[1] Five days after operation. Acidosis. Blood urea 108. Carcinoma of pancreas with metastasis to regional nodes found at necropsy.

	Number
Postoperative details	
Careful of diet	33
Not careful of diet	19
Gained in weight	34
Normal weight	9
Lost in weight	3
Hæmatemesis 15 months after operation	1
Examinations	
Roentgen-ray: Negative	2
Duodenum deformed	3
Duodenum deformed and stomach enlarged	2
Gastric analysis:	
Combined acids (average)	75
Free acids (average)	55

The data in Tables 1 and 2 were taken from three groups of cases. In the first group the ulcer was excised without touching the pyloric sphincter. In the second group, besides the excision of the ulcer, the pylorus was cut across but no portion of the muscle was excised (Table 1). These operations were all performed from 2 to 10 years ago. In Table 2 the data were obtained from a study of a group of cases in which the cap of the duodenum was excised together with the anterior portion of the pyloric sphincter. In studying groups of cases statistically we must keep in mind that there are many sources of error. The immediate results of this operation are very gratifying and convalescence is usually very smooth and free from vomiting, retention, and gastric distress. The operation is carried out with the stomach and the duodenum open. With ordinary precautions against soiling, the wound has healed well. Alvarez has studied a number of these cases 2 or 3 weeks after operation and has found that in some of them the stomach is a little slow in emptying. In all of the cases studied several weeks after operation the emptying time was normal. In no case has there been stricture or narrowing of the duodenum. The gastric acids are reduced after the operation but not quite to the extent that follows gastro-enterostomy. In most instances, shortly following the operation, the gastric acids were practically normal. In making roentgenological examinations after operation on the duodenum, one must bear in mind that the deformity which results from the operation is much the same as that which results from a duodenal ulcer, so that the roentgenologist

can be of very little service in deciding whether an ulcer has recurred in these cases. In some instances the roentgen-ray shows very little deformity.

Besides the cases reported here, excision of ulcer, partial resection of sphincter and gastroduodenostomy, have been performed in 120 additional cases, but too recently to justify a report on the ultimate results. The immediate results have been just as satisfactory, with no mortality.

As a result of several years' experience with excision and partial duodenectomy, we believe that, when it can be satisfactorily carried out, it has distinct advantages over gastroenterostomy.

THE ETIOLOGY OF EMPYEMA[1]

Hæmothorax in Idiopathic and Postoperative Empyema

By DUFF S. ALLEN, M.D., St. Louis, Missouri

THE factors which lead to the production of an empyema are not fully understood. Why does one patient develop empyema whereas a second patient with apparently an identical condition does not? This is an appropriate question in regard to all types of acute empyemata.

The purpose of this paper is to present a study of one of the etiological factors of empyema following intrapleural operations, namely, the relation between hæmothorax occurring at the time of the operation and empyema following a thoracotomy in a chest not previously infected. In addition to this, we will discuss the relationship between spontaneous hæmorrhage into the pleural space and the occurrence of idiopathic acute empyema associated with or following pneumonia.

Postoperative Empyema

The risks which the patient who has had a thoracostomy or a thoracotomy encounters during the postoperative period are, of course, those risks which follow every major operation; but there are additional and unique risks which follow intrapleural operations. In the main, these special risks are those of asphyxia and empyema.

Asphyxia, when it occurs after an intrapleural operation, usually follows a thoracostomy, such as in the early drainage of an infected pleural cavity, and, here, like the asphyxia which may occur during the operation, it is the direct result of an open pneumothorax. It is at once evident that such postoperative asphyxia is not likely to be encountered in patients who have had their pleural cavities obliterated by adhesions or in whom the incision into the pleural cavity is firmly sutured at the end of the operation. In the latter cases—those with thoracotomy—the symptoms of asphyxia may result, however, from an accumulation of any kind of fluid, postoperatively, in the pleural cavity.

The effects of postoperative asphyxia in cases with thoracostomy had not been thoroughly studied nor had their significance been fully recognized prior to the epidemic of influenza and empyema during the World War. The experimental work of Graham and Bell (6) emphasized the fact that when the vital capacity is low, such as is commonly found in an acute empyema associated with a pneumonia, the danger from asphyxia resulting from an open pneumothorax is present not only during the operation[2] (thoracostomy) but persists throughout the days following the operation. In such cases, with low vital capacity, death

[2] The criticisms which were raised by many against the significance of this work have been answered, and the original work has been extended in a recent Harvey lecture by Graham, entitled, "Alterations of Intrapleural Pressure and Their Significance." *Medicine*, 1924, iii, 417.

[1] From the Department of Surgery, Washington University School of Medicine and Barnes Hospital, St. Louis.

from asphyxia is not an infrequent postoperative result of the open drainage of the pleural cavity. The recognition of this fact has completely revolutionized the surgical management of acute empyema from a procedure which contemplated thoracostomy as soon as an infection of the pleural cavity was diagnosed to a procedure which advocates procrastination of open drainage until adhesions between the pleura of the lung and the costal pleura have effectively walled off the empyema, or until the vital capacity has increased owing to the subsidence of the pneumonia.

Such rational procedures when applied to aspects of intrapleural surgery other than that for empyema should be, and they have been, of great value. The intentional production of adhesions between the costal pleura and the pleura of the lungs is often carried out before a thoracostomy or a thoracotomy is attempted. The vital capacity maintains its important rôle.

Empyema following uncomplicated thoracostomy or thoracotomy is, unfortunately, a serious and an all too frequent event. The causes for the occurrence of empyema after "clean" operations upon the pleural cavity have not been fully recognized. Our experimental work reported here bears directly upon one of the causes of such postoperative empyema.

It has long been observed that a serious empyema follows thoracotomy with a much greater frequency than the frequency with which a serious peritonitis follows laparotomy. The occurrence of such an empyema has been variously ascribed to (1) the result of the open pneumothorax and its accompanying "operative insults" to the pleura at the time of the operation; (2) the result of excessive aspiration of bacteria during the operative procedure and, in thoracostomies, of continued aspiration of bacteria after the operation had been finished; and (3) the result of a remaining closed pneumothorax after completion of a thoracotomy.

It is not our purpose to deny the possibility of the rôle played by any one of these three mentioned etiological factors in the production of an empyema following intrapleural operations, but rather to stress the importance of hæmothorax as an etiological factor of empyema.

A brief elucidation of the above mentioned factors which have been considered most frequently as the causes for empyema following chest operations is necessary for the proper perspective to our experimental work reported here on the relationship of hæmothorax to the production of empyema.

The effect of an open pneumothorax in the occurrence of empyema following a thoracotomy was first studied by Noetzel (12). In a comprehensive experimental study he found when bacteria were injected into the pleural cavity after an open pneumothorax had been produced by a thoracotomy that empyema followed much more rapidly and more frequently than when the same amounts of the same culture of bacteria were injected into the pleural cavity without the production of an open pneumothorax. He considered this difference in susceptibility of the pleura to infection to be due, mainly, to the effect of the air upon the pleura as well as to the possible deleterious effect upon the circulation within the lung resulting from a collapse of the lung itself. Tiegel (14) repeated these experiments of Noetzel and found similar results. He also considered the increased susceptibility to empyema following an open pneumothorax to be due to the effects of the pneumothorax such as drying and cooling of the pleura, but, in addition to these, to the mechanical insults to the pleura such as that due to rubbing by compresses or by the hand of the operator and to the trauma resulting from the careful wiping out of the blood in the pleural cavity. Tiegel noted the presence of a hæmorrhagic fluid in the pleural cavity soon after the thoracotomy. He considered this hæmorrhagic fluid to be the result of the infection in the pleural cavity. Our experimental evidence, in contrast to this, indicates that the blood had been present in the pleural cavity before the infection had been established and that this hæmorrhage into the pleural cavity had aided in the establishment of the infection.

Aspiration of many bacteria into the free pleural cavity is possible in any operation which produces an open pneumothorax. We have not found the report of definite evidence

which would prove that this excessive contamination actually occurs, nor is such evidence necessary. It is well known that certain bacteria are air borne. It is reasonable to agree, therefore, that, if an excessive volume of ordinary room air were to come in contact with the pleura, an excessive contamination might result. Such contamination may take place not only at the time of the operation but also during the postoperative period, especially when the opening into the pleural cavity is of a moderate size. In the consideration of contamination of the pleura through aspirated bacteria in these instances, one fact is to be remembered, namely, that bacteria in the pleural cavity will, of themselves, seldom produce an experimental empyema. This is well illustrated by the injection of a suspension of bacteria into the pleural cavity and was fully recognized by Noetzel and Tiegel. Our experiments to be reported here confirm this fact.

Something else, in addition to the presence of bacteria, seems to be necessary in the normal pleural cavity for the production of an empyema.

The rôle of a closed pneumothorax in the production of an empyema has been of interest not only to the thoracic surgeon but also to the internist who has used the closed pneumothorax extensively in the treatment of pulmonary tuberculosis. A closed pneumothorax remaining after an intrapleural operation has been completed differs materially from a closed artificial pneumothorax produced merely by the injection of air through a needle. In the former instance, an open pneumothorax with opportunity for various types of trauma to the pleura and the establishment of a hæmothorax has immediately preceded the closed pneumothorax; in the latter instance the closed pneumothorax is contained within an untraumatized pleura. Bettman (3) has shown, however, that there is a change in the absorptive power of the pleura for particulate matter following a simple closed pneumothorax produced by injection of air into the pleura without thoracotomy. Hedblom (7) made a clinical study of cases in which the pleural cavity was opened without differential pressure, with a remaining closed pneumothorax, and 18 cases in which differential pressure was used and in which there was little or no remaining closed pneumothorax. He found that "11 per cent of patients operated on with differential pressure anæsthesia developed complications while 28 per cent of patients operated on without differential pressure and in whom pneumothorax occurred, developed complications. Pleural effusion, both serous and purulent is of much greater incidence in cases in which pneumothorax is produced. Empyema was the most potent cause of death in this group of cases; and it is reasonable to believe that the presence of pneumothorax at least contributed to the development of this complication."

There is evidence, therefore, that the presence of a remaining closed pneumothorax after thoracotomy favors the formation of postoperative empyema. The relative importance of this factor and other factors, such as a remaining hæmothorax, has not been determined.

The significant rôle played by the remaining hæmothorax in the development of empyemata after a "clean" thoracotomy seems to have failed to receive serious consideration. Perhaps this is due to the fact that the hæmothorax may be formed in a very inconspicuous manner—a little blood trickles down into the pleural cavity. Open pneumothorax, on the contrary, commands attention in a loud voice, and, hence, has been given an erroneous value as an etiological factor for such empyemata. Hæmothorax, following accidental wounds of the chest during the World War, led to empyema in 25 per cent of the cases (5). "Complete pneumothorax without hæmothorax requires watching in respect to the possibility of sepsis occurring; but infection does not often develop in them." Aspiration of the hæmothorax was found to be advisable.

The fact that clotted blood in any part of the body may be the nidus of infection needs no elaboration. The peritoneum and omentum of the abdominal cavity take care of a hæmoperitoneum in an admirable fashion. Our experience leads us to believe that the pleuræ are not so efficient in this respect, especially if the blood is contaminated by the presence of bacteria.

Experimental Hæmothorax as an Etiological Factor in the Production of Empyema

THORACOTOMY

The important rôle played by a hæmothorax in the production of empyema came to our attention first in our early experimental work for incision of the mitral valve (2). In the first series of these experiments, 21 thoracotomies were performed, of which the following experiment is typical.

Experimental Series I. Exp. 14. Under ether anæsthesia, administered through the Gesell-Erlanger intratracheal, intermittent, positive pressure apparatus, the fourth left rib is removed, subperiosteally, from its posterior angle to the costal cartilage. The pleural cavity is opened widely and the left lung is packed away from the pericardium with a large sheet of moist silk. The pericardium is split over the base of the left auricular appendage and the left appendage is brought outside of the pericardium. The base of the appendage is clamped off with a specially constructed, weak-jawed, right-angled, rubber-jacketed clamp. The tip of the appendage is incised, the end of the cardioscope is tied into the appendage and the clamp is removed from the base of the appendage. No bleeding follows. The lens of the cardiscope is pushed gently into the auricle which is inspected. A cusp of the mitral valve is identified by vision and grasped between the knife blade and the lens. The valve cusp is re-inspected and incised. Moderate bleeding takes place around the cardioscope. The lens end of the cardioscope is withdrawn into the left auricular appendage, the appendage is ligated near its base and amputated. The pericardium is then sutured.

The silk sheet is now removed from the pleural cavity and the incision in the chest wall is closed. The pleura and periosteum form the first layer. They are closed by a continuous suture and just before the last stitch is placed the trachea is compressed around the intratracheal tube by the anæsthetist to expand the lungs fully and thus to drive out all the air in the pleural cavity. This increased positive pressure is maintained until the muscle layers are overlapped to make the wound air-tight. The wound is closed without drainage.

TABLE I.—SERIES I, II, III, AND IV

	Experimental procedures	Total number individual experiments	Soiling of pleural cavity with blood	Incidence of empyema Per cent
Series I.	Transauricular incision of mitral valve	21	Moderate	85
Series II.	Transauricular incision of mitral valve	27	Slight	7
Series III.	Transauricular incision of mitral valve	22	Slight	14
Series IV.	Transventricular ligation of chordæ tendinæ	18	Marked	100

In this series of 21 experiments (Series I), empyema followed the thoracotomy in 18 instances, 85 per cent (Table I).

Experimental Series II. In the next 27 consecutive and similar experiments (Series II) for incision of the mitral valve (Table I), empyema followed the thoracotomy in only two instances, 7 per cent. The same rigid, aseptic, careful technique had been followed in both Series I and Series II.

The sudden cessation of the occurrence of empyema was difficult to explain. A thorough investigation was made in both series of all the details connected with the operative procedure, such as the methods for sterilization of supplies, sanitation of cages, preparation of the field of operation, disease among the stock dogs, laxness on the part of the personnel, variation in length of the duration of the open pneumothorax, temperature and sanitation of operating room, trauma to the pleura and the postoperative care of the animals. There had been no notable variation in any of these details in either of the two series, certainly not enough to explain the sudden drop in the incidence of empyema from 85 to 7 per cent.

This experimental work for cutting the mitral valve was continued. Our primary

object was the development of a practicable surgical procedure for the relief of mitral stenosis, but the experiments had taken on an added interest in that they served for the study of the occurrence of empyema following a thoracotomy in a pleural cavity which had not been infected before the operation.

Experimental Series III and IV. A third series of experimental incision of the mitral valve (Series III) was begun in December 1922 (Table I). The same technique was followed as in Series I and Series II. Along with this Series III for incision of the mitral valve, a different operation was carried out upon the hearts of other animals (Series IV). In this, Series IV, a specially constructed needle, carrying a stout silk ligature, was passed blindly through the wall of the ventricle to encircle the chordæ tendineæ of the mitral value, thereby producing a mitral stenosis (1). These two series of experiments, III and IV, were carried on at the same time and thus the thoracotomies of the one series were interspersed with the thoracotomies of the other series. A thoracotomy for the transauricular incision of the mitral valve performed on the one day was often followed by a thoracotomy for the transventricular ligation of the chordæ tendineæ of the mitral valve performed on the following day and this latter operation in turn was followed by the former operation on the third day, etc.

Twenty-two experiments were done for cutting the mitral valve (Series III), of which only 3, or 14 per cent, were followed by empyema; 18 experiments were done for tying the chordæ tendineæ (Series IV), of which 18, or 100 per cent, were followed by empyema. The individual experiments had been interlaced the one with the other in the two series of similar thoracotomies, performed under almost exactly the same conditions of asepsis, with about the same duration of the open pneumothorax, the same opportunity for contamination of the pleural cavity with bacteria, practically the same amount of trauma to the pleura, and under the same extraneous conditions. Why should the one series of thoracotomies (Series III) be attended with empyema in only 14 per cent of the animals, while its concurrent series (Series IV) was being attended with empyema in every experiment, 100 per cent? (Table I.)

TABLE II.—SERIES V

Exp. No.	Amt. hæm. streptococcus suspension. Cubic centimeters	Autogenous blood Cubic centimeters	Empyema	Killed or died	Days	Pleural culture
1	1	0	0	K	7	Sterile
2	1.5	2	Turbid fluid	K	1	Streptococcus hæmolyticus
3	2	0	0	K	9	Sterile
4	1	0	++	D	8	Streptococcus hæmolyticus
5	1.2	1	++	D	19	Streptococcus hæmolyticus
6	1.4	0	Turbid fluid	K	1	Streptococcus hæmolyticus
7	1	0.5	+++	D	8	Streptococcus hæmolyticus
8	2	0	0	K	14	Sterile
9	1	2.5	++	K	7	Streptococcus hæmolyticus
10	1	1	+++	K	45	Sterile
11	1.5	0	0	K	16	Sterile
12	1.1	2	++	D	22	Sterile
13	1	0	++	D	11	Streptococcus hæmolyticus
14	2	2	+++	K	16	Streptococcus hæmolyticus
15	1.1	0	0	K	12	Sterile
16	1.4	0	0	K	8	Sterile
17	1.2	0.5	+++	K	12	Streptococcus hæmolyticus
18	1.0	1.0	++	D	10	Streptococcus hæmolyticus
19	2	0	0	K	8	Sterile
20	1.5	0	Turbid fluid	K	1	Streptococcus hæmolyticus
21	2	0	++	K	30	Sterile
22	1.5	0	0	K	40	Sterile

The high percentage of empyema following attempted ligation of the chordæ tendineæ of the mitral valve could not be accounted for by an impairment of the pulmonary circulation through the formation of a mitral stenosis since, by the insertion of a needle blindly through the wall of the left ventricle to carry the ligature around the chordæ tendineæ the chordæ tendineæ had been missed or ineffectively encircled by the ligature in 6 of

TABLE III.—SERIES VI[1]

Exp. No.	Attenuated pneumococcus Type IV. Cubic centimeters	Autogenous blood Cubic centimeters	Empyema	Killed or died	Days
1	1.2	0	0	K	32
2	1.5	2	0	K	32
3	1.1	0	0	K	12
4	1.2	1.5	0	K	12
5	1.5	0	0	K	30
6	1	1	0	K	20
7	2	0	0	K	5
8	1	1.5	Turbid fluid	K	2
9	1.3	0	0	K	4
10	1.5	2	0	K	10
11	2	0	0	K	6
12	1	1	0	K	8
13	1.6	0	0	K	14
14	1.5	1.5	0	K	24
15	1.2	0	0	K	23
16	1	1	0	K	26

[1] Pleural culture was sterile in all cases.

TABLE IV.—SERIES VII

Exp. No.	Amount pneumococcus Type IV attenuated. Cubic centimeters	Autogenous blood Cubic centimeters	Empyema	Killed or died	Days	Pleural culture
1	1.5	0	0	D	2	Pneumococcus Type III
2	1	1	+	D	4	Pneumococcus Type III
3	2	0	0	D	5	Pneumococcus Type III
4	2	1	+	D	2	Pneumococcus Type III
5	1.2	0	0	D	3	Sterile
6	1	1	+	D	1	Pneumococcus Type III

the 18 attempts. These 6 animals had, therefore, only a ligature passing into and out of the cavity of the left ventricle. Nevertheless, they all developed empyema.

Discussion of experimental Series I, II, III, and IV. An analysis was made of the four series of thoracotomies, a total of 88 experiments. In Series I, II, and III (thoracotomy for the transauricular incision of the mitral valve), empyema had followed the operation in 18 of 21 experiments, 85 per cent; in 2 of 27 experiments, 7 per cent; and in 3 of 22 experiments, 14 per cent, respectively. In Series IV, thoracotomy for the transventricular ligation of the chordæ tendineæ of the mitral valve, empyema had followed the operation in 100 per cent of the 18 experiments.

A careful study of the records of the observations made during the various operations on the mitral valve revealed an unsuspected factor in those experiments for cutting the mitral valve by use of the cardioscope inserted through the left auricular appendage. In the first series of these experiments (Series I), in which the thoracotomy had been followed by a high percentage of empyema, 85 per cent, a small drop of solder on the handle of the knife attachment of the cardioscope had allowed bleeding to take place around the cardioscope while the valve was being held between the lens and the knife blade (2) for inspection prior to incision, and also while the valve was being incised. This hæmorrhage had soiled the pleura. The blood had not been removed from the pleural cavity before closure of the thoracotomy wound.

The drop of solder had been removed from the handle of the knife after the completion of Experiment 20 in Series I. Following this, not more than 1 cubic centimeter of blood had entered the pleural cavity during the thoracotomy and incision of the mitral valve; and the incidence of empyema following the thoracotomy had suddenly dropped from 85 per cent (Series I) to 7 per cent (Series II).

Likewise, the soiling of the pleural cavity from hæmorrhage during the operation had been marked in those experiments in which a needle had been passed from without into the cavity of the left ventricle (Series IV) for tying the chordæ tendineæ. The incidence of empyema following this operation in Series IV had been 100 per cent, while the concurrent transauricular experiments for incision of the mitral valve in which there was but very little soiling of the pleura from hæmorrhage had been followed by empyema in only 14

per cent of the experiments. This seemed significant.

From these results in the four series of a total of 88 thoracotomies we felt justified in the conclusion that soiling of the pleural cavity by hæmorrhage at the time of the thoracotomy had been a very important etiological factor in the production of the empyema which developed after the thoracotomy had been completed.

This conclusion seemed to be a logical one. Certainly, the clotted blood in the warm, moist pleural cavity should serve as an excellent medium for the growth of bacteria placed in an especially favorable environment for their growth. We did not doubt that a hæmothorax resulting from the spilling of blood during a thoracotomy was an important factor in the production of the empyemata following such operations.

We were not entirely convinced, however, that this conclusion would hold good for those cases of empyemata which occur spontaneously and which do not follow intrapleural operations.

The effect of an open pneumothorax with its accompanying cooling and drying of the pleura, as well as the other "operative insults" to the pleura due to the unavoidable manipulations during the operations had *not* been followed by an empyema in most of these experiments in which there was but very little soiling of the pleura from hæmorrhage. These factors, other than hæmothorax, might have been important contributing causes to the occurrence of the empyema which followed in those experiments in which fairly marked soiling of the pleura with blood had taken place during the operation. If the empyema had resulted mainly from the presence of blood in the contaminated pleural cavity, then a pleural cavity into which bacteria had been injected and to which autogenous blood —and nothing else—had been added should be expected to develop an empyema in a high percentage of instances.

Accordingly, a fifth series of experiments was begun which would bear directly on the subject of hæmorrhage in the pleural cavity as an important etiological factor in the occurrence of empyema.

TABLE V.—SERIES VIII

Exp. No.	Amount pneumococcus type I. Cubic centimeters	Autogenous blood Cubic centimeters	Empyema	Killed or died	Days	Pleural culture
1	1	0	0	K	48	Sterile
2	1	1	+	D	5	Pneumococcus Type I
3	1.2	1.5	++	D	5	Pneumococcus Type I
4	1.6	0	0	K	10	Sterile
5	1	1	++	D	7	Pneumococcus Type I
6	2	0	0	K	6	Sterile
7	1.2	2	++	D	6	Pneumococcus Type I
8	1.2	0	+	D	7	Pneumococcus Type I
9	1.1	1	++	D	5	Pneumococcus Type I
10	1	0	0	K	27	Sterile
11	1	1.5	+++	D	7	Pneumococcus Type I
12	1	1	++	D	8	Pneumococcus Type I
13	2	0	0	K	68	Sterile
14	2	0	0	K	68	Sterile
15	1.2	1	++	D	6	Pneumococcus Type I
16	2	1.2	++	D	7	Pneumococcus Type I
17	1.5	0	0	D	12	Sterile
18	1	1	++	D	5	Pneumococcus Type I

EMPYEMA AFTER INJECTION OF BACTERIA AND BLOOD INTO THE PLEURAL CAVITY

Experimental Series V. Twenty-two experiments were done in which a 24-hour blood-agar culture of a hæmolytic streptococcus, obtained from a patient with acute empyema, was injected into the pleural cavity of rabbits (Table II). Nine of these had, in addition to the bacteria, an amount of autogenous blood, from 0.5 to 2 cubic centimeters injected into the same pleural cavity. All of these 9 developed an empyema (100 per cent). In 11 of the remaining 13 experiments in which no blood was intentionally injected into the pleural cavity the animals were allowed to live long enough for the development of an empyema. Two were killed at the end of 24 hours. Of these

11 control animals in which a suspension of bacteria in normal saline solution had been injected into the pleural cavity, only three (27 per cent) developed an empyema. The remaining 8 were killed and at autopsy showed surprisingly normal pleuræ and lungs, both when examined grossly and microscopically. None of the 8 had empyema (Table II).

The details of these experiments are shown in experiment No. 17, August 19, 1925. A rather blunt pointed needle is fitted to a hypodermic syringe filled with a suspension of hæmolytic streptococci. All bubbles of air are removed from the syringe and needle. The needle is passed through the skin of the right chest at about the level of the eighth rib. The point of the needle is then directed caudalward and comes to lie near the upper border of the eighth or ninth rib. The point is then dipped downward to pass below the posterior aspect of the rib. It is felt to pierce the pleura and is inserted 3 or 4 millimeters further while 1.2 cubic centimeters of the suspension of bacteria is being injected slowly into the pleural cavity. The needle is then withdrawn. A second syringe and needle is now employed. The needle is inserted between the ribs of the left (opposite) chest and 1 cubic centimeter of blood is aspirated from the heart. The original needle is reinserted into the right chest, in exactly the same manner as before, and 0.5 cubic centimeters of autogenous blood is injected into the right pleural cavity to act as a medium for the growth of the previously injected bacteria. The rabbit does not cough nor show marked respiratory distress. There is no hæmatoma or tumor mass palpable in the chest wall after the injection of either the suspension of bacteria or the blood. X-ray shows hydrothorax (faint) but no pneumothorax.

August 20. Rabbit does not appear sick. Is hopping about the cage and appears to be as lively as its mates.

August 21. No change, chest not dull to percussion.

August 24. Rabbit not lively. Chest not dull to percussion. X-ray shows some fluid in left chest. No pneumothorax.

August 27. Rabbit visibly thinner. Looks haggard. Still fairly lively when one tries to pick it up. Chest percussion indefinite. Breath sounds heard over left chest but not nearly so loud as over right.

August 30. Rabbit looks unkempt, does not eat but is fairly active. Chest as before.

August 31. Rabbit dead in cage.

Autopsy. Marked empyema with pus and fibrinous lumps over entire left pleural cavity. It seems incredible that such an extensive process would not have given more objective signs during life. No abscess of lung but pleura markedly thickened. Lung collapsed to ½ the size of the chest cavity. Enlarged glands, ½ centimeter in length are found around the trachea. There is no abscess of liver or kidneys. The peritoneum is glistening everywhere. Culture: Hæmolytic streptococci.

Microscopical. The cells of the serosa covering the lung can be made out in places. There is a fibrinous exudate over the serosa which contains many polymorphonuclear cells and a lesser number of round cells. Beneath the serosa many polymorphonuclear cells are seen in the adjacent alveoli. There is marked atelectasis of the alveoli near the periphery.

The relative frequency of the occurrence of empyema after injection of the hæmolytic streptococcus alone and the same hæmolytic streptococcus plus 1 to 2 cubic centimeters of autogenous blood into the chest of a rabbit is shown in Table II. If a small quantity of blood were added immediately to the pleural cavity which had been contaminated by the hæmolytic streptococcus, empyema followed in every instance. The controls in which no blood was added to the suspension of hæmolytic streptococci showed a lower percentage of empyema.

In these experiments in which blood and hæmolytic streptococci were carefully injected into the pleural cavity with a syringe, there was no complicating open pneumothorax, and hence, drying and chilling of the pleura could not have been responsible for the resulting empyema. Likewise, there had been no thoracotomy with its opportunity for mechanical injury to the pleura. The experiments added a definite proof, therefore, that hæmorrhage into the pleural cavity had been an important factor in the production of empyema following those intrapleural operations in the Experimental Series I, II, III, and IV.

HÆMOTHORAX AS AN ETIOLOGICAL FACTOR IN THE PRODUCTION OF ACUTE EMPYEMA DUE TO THE PNEUMOCOCCUS

It seemed reasonable to infer from the above discussion and experimental facts obtained with the streptococcus that blood in the pleural

cavity which was contaminated by the pneumococcus would also produce an acute empyema.

This appeared to be worthy of experimental investigation.

Accordingly, the sixth series of these experiments was carried out. A suspension in normal saline solution of a 48-hour blood agar culture of the pneumococcus, Type IV, was injected into the pleural cavity of 16 rabbits, by the same technique as was used in the hæmolytic streptococcus series. One to 2 cubic centimeters of autogenous blood was injected into the chests of 8 of these 16 rabbits. The remaining 8 animals were allowed to live as controls. Not a single one of the 16 rabbits developed an empyema. None of them died following the injection of pneumococcus, or pneumococcus and blood into the pleural cavity. The pneumococcus used in this series, however, had been grown on artificial media in the laboratory for several months prior to its use for inoculation and it had therefore lost its virulence.

The series is included here only for its value as a control for the remaining experimental series. It shows that the aspiration of blood from the heart and the presence of blood alone in the pleural cavity of this series (VI) and similar experiments (Series V, VII, and VIII) would not be expected to cause the death of the animal or to lead to the formation of an empyema. Empyema following the injection of blood and bacteria in other experiments is evidently due to the combined effect of the bacteria aided by the presence of the blood in the pleural cavity.

Series VII: Experiments with Pneumococcus, Type III. Another series of experiments (Series VII), was carried out in which a virulent pneumococcus, Type III, was injected into the pleural cavity of 6 rabbits. In 3 of these 1 cubic centimeter of autogenous blood has also injected. All of these 6 rabbits died within the following 5 days. Only the 3 rabbits, however, in which blood was added to the pleural cavity containing the pneumococcus showed an empyema at autopsy. The 3 controls, in which pneumococcus alone had been injected into the pleural cavity, showed a surprisingly normal pleural space at autopsy. There was no empyema in either of the 3 controls, although the pneumococcus was recovered from the surface of the pleura in 2 of them. The heart's blood contained pneumococci in one of the controls. They died of a pneumococcal septicæmia. The results of this series of experiments are shown in Table IV.

Series VIII: Experiments with pneumococcus, Type I. A suspension, in normal saline, of a 36 hour blood agar culture of an unattenuated pneumococcus, Type I, was injected into the chest cavity of 18 rabbits. The same technique was used in this series of experiments for injecting the bacteria into the pleural cavity as had been used in the preceding series. Likewise, the particles of agar were carefully removed from the suspension by the centrifuge.

In 10 of these 18 experiments, from 1 to 2 cubic centimeters of autogenous blood was injected into the pleural cavity immediately after the introduction of the pneumococci. The remaining 8 animals were used as controls.

The animals selected for these experiments were all of almost equal size, the same species, and had lived in the same surroundings since birth. They were young, full grown rabbits. They were kept in pens in the one room after the pneumococci or pneumococci with blood had been injected into the pleural cavity. Each rabbit received the same kind of food at all times.

The results of this series of experiments were very striking (Table V).

Every rabbit in which blood was introduced into the pleural cavity along with the pneumococci developed empyema and died. In those rabbits in which like amounts of the suspension of pneumococci were introduced without the intentional introduction of blood, only 2 of the 8 died, and only 1 of these 2 had empyema. At autopsy, it seemed very evident that this 1 control rabbit had had bleeding into the pleural cavity from the needle wound. The remaining 6 control animals were killed and none was found to have developed an empyema.

The results of this series of experiments are shown in Table V.

Clinical Observations

HÆMORRHAGE INTO THE PLEURAL CAVITY AS AN ETIOLOGICAL FACTOR OF IDIOPATHIC EMPYEMA DUE TO THE STREPTOCOCCUS

The series of experiments in which hæmolytic streptococci were obtained from a patient with acute empyema and injected into the normal pleural cavity of rabbits along with a small amount of blood serve not only to demónstrate the important rôle of hæmorrhage into the pleural cavity in the production of empyema following intrapleural operations, but, in addition, they indicate the probability that an acute empyema following or associated with a pneumonia may be established, in truth, by the spontaneous occurrence of hæmorrhage into the pleural cavity. There are abundant opportunities for the extrusion of blood into the pleural space in cases of pneumonia from causes such as the rubbing together of the inflamed pleural surfaces—which are often covered with granulation tissue—or, perhaps, through rupture of a small vessel of the inflamed pleura as the result of violent coughing.

The causes of the occurrence of acute empyema following or associated with pneumonia are usually considered to be due (a) to the extension of the infection to the pleural surface through blocked lymphatics (5, 8), and (b) to the rupture of a subpleural abscess into the pleural space (10). We do not wish to doubt the probability of either of these causes. Rather, we hope to point out the fact that the development of an acute empyema may be the result of a spontaneous hæmothorax which has become infected. The presence of septicæmia in patients who have pneumonia makes it possible for the bacteria to be carried into the pleural space through the blood stream itself. Bacteria may reach the pleural cavity, however, directly from the lung.

Whether hæmorrhage into the pleural cavity actually does occur to instigate the formation of an acute empyema as it is met with in patients is not proved, of course, by these experiments in rabbits. They do indicate, however, that, if such hæmorrhage were to take place into the pleural cavity, empyema would be far more likely to be the result than if there were no free blood in the pleural cavity.

It is at once apparent that the question as to whether intrapleural hæmorrhage does take place in patients who later develop a streptococcus empyema can be ascertained only through observations made upon such patients themselves. Two cases of empyema due to the hæmolytic streptococcus developed in the Barnes Hospital at the time when this investigation had reached this point. The usual diagnostic aspiration of the pleural cavity was carried out in each instance as soon as the presence of fluid could be suspected from the clinical and physical signs combined with X-ray and fluoroscopic examinations. The fluid obtained from the infected chest cavity in this early stage in the development of the acute empyema was of a bloody color and contained myriads of laked red blood corpuscles. There could be no doubt, in either patient, that the fluid in the chest cavity contained blood.

The fact that bloody fluid may be aspirated from the pleural cavity in patients who are developing an acute empyema due to the streptococcus is so well known that it needs no further elaboration. Everyone who has observed such cases must have observed this fact. In the streptococcus empyema associated with the epidemic of influenza during and immediately following the World War, bloody fluid was aspirated, almost universally during the first days of the development of the infection in the pleural cavity (9). The significance of this finding does not seem to have been fully appreciated. When this fact is viewed in the light of our experimental work, however, one can not escape the conclusion that the blood in the pleural cavity was an important etiological factor in the production of these acute empyemata in which the hæmolytic streptococcus was the infecting organism.

HÆMOTHORAX AS AN ETIOLOGICAL FACTOR IN THE PRODUCTION OF IDIOPATHIC EMPYEMA DUE TO THE PNEUMOCOCCUS

We have seen in patients that there is definite clinical evidence that blood is present in marked amounts in the earliest stages of the development of a streptococcal empyema.

Likewise, we must seek the patient for evidence of the presence of blood in the pleural cavity at the beginning of the development of an acute pneumococcal empyema. Does hæmorrhage into the pleural space really occur in these cases which develop an acute pneumococcal empyema? If it does, then, in the light of these experiments, we must conclude that it could have been very instrumental in the production of the full blown empyema.

Perhaps the best evidence of the presence of blood in any cavity is the presence of large amounts of red blood cells.[1] In the early stage of an acute streptococcal empyema, this is indicated by the reddish brown color of the fluid. In acute pneumococcal empyema, however, one seldom finds red or brown fluid. Instead, the fluid aspirated from the pleural cavity in the early stages of these cases is usually of a greenish tint. This, nevertheless, is significant. The green color is due to a derivative of the hæmoglobin of the red blood cells—methæmoglobin or an isomer of methæmoglobin (4). The presence of the greenish color in the fluid which is aspirated from the pleural space early in the development of acute pneumococcal empyema is proof of the presence of blood.

This evidence of the presence of blood in the pleural cavity in the early development of pneumococcal empyema is almost always present. Furthermore, at necropsy, in a patient dying of pneumococcal pneumonia, not infrequently the pleura of the lung is covered or replaced by granulation tissue, and often the pleural cavity contains several cubic centimeters of bloody fluid (9). The experiments with the hæmothorax which were intentionally contaminated with virulent pneumococci indicate the facility with which this bloody fluid could be changed into an empyema by a contamination with pneumococci in any manner.

SUMMARY

The risks met with during intrapleural operations, in cases in which the pleural space is not obliterated by adhesions, are chiefly those which attend asphyxia. The vital capacity obtained before operation is a reliable index for the danger from asphyxia which will be encountered during and after the operation. Dependable apparatus for artificial respiration should always be available for such operations.

The postoperative risks in patients with intrapleural operations are of more consequence than those occurring during the operation. Postoperative asphyxia in thoracostomies for empyema should be guarded by a procrastination of the operation until the vital capacity has risen safely above the tidal area.

Postoperative empyema in chests not previously infected may be the result of trauma to the pleura (mechanical), or drying and chilling. It may also be the result of a hæmothorax.

A total of 150 experimental observations are recorded in this experimental series. In 40 experiments, moderate or excessive hæmothorax with excessive contamination by virulent micro-organisms occurred; in 40 animals, 100 per cent, empyema developed. Twenty-four control animals were given the same excessive contamination of the pleural cavity with virulent organisms, but without intentional hæmothorax; 3 of these, or 12 per cent, developed empyema. Twenty-one animals had moderate hæmothorax with contamination by micro-organisms at careful "aseptic" thoracotomy; 18, or 85 per cent of these animals, developed empyemata. Forty-nine animals had "aseptic" thoracotomy with slight hæmothorax; 5, or 10 per cent, of these developed empyemata. The pleural cavities of the remaining 16 experiments were contaminated by an attenuated pneumococcus with and without hæmothorax but none developed empyema.

These experimental results indicate the important rôle played by the hæmothorax, acquired during a thoracotomy, in the production of empyema following the operation. Hæmorrhage into the pleural cavity can be controlled by careful attention to hæmostasis before the pleural cavity has been opened and during the intrapleural procedures. This should be done.

The early stages of idiopathic, streptococcal, and pneumococcal empyemata usually show

[1] Red blood cells are normally present in the pleural cavity, but in relatively small numbers.

evidence of hæmothorax. In view of this experimental data, the probability is evident that idiopathic empyema is engendered, in truth, by a preceding, spontaneous hæmothorax. The clinical evidence for this probability is abundant.

CONCLUSIONS

1. Postoperative complications of intrapleural operations are often more serious than those complications which may arise during the operation.

2. Postoperative empyema may be the result of a hæmothorax acquired during the thoracotomy or thoracostomy.

3. Hæmostasis should be complete before and after the pleural cavity is entered.

4. Idiopathic empyema may be ushered in by a spontaneous hæmothorax which is or becomes infected with the pneumococcus or the streptococcus.

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THYROID AND PARATHYROID BONE TUMORS WITHOUT PRIMARY LESION OF THE THYROID GLAND[1]

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IT is well known that tumors of thyroid origin have a striking predilection to metastasize to bones; in fact, malignant growths of the thyroid, breast, prostate, and suprarenals metastasize to the skeleton much more often than do any of the other types of malignant tumors.

In Schmidt's (19) statistics the relative frequency with which the various neoplasms involve the skeleton is so represented; mammary gland, prostate, thyroid, stomach; more seldom the uterus and gall bladder; still more seldom, the liver, urinary bladder, ovary, bronchi, and pancreas. Tumors of suprarenal type are not mentioned, but we know today that they frequently metastasize to bones.

It is also worth remembering that while prostate and mamma cancers metastasize to the lymph glands, pleura, lungs, and liver even more often than to bones, epithelial tumors of thyroid as well as those of suprarenal origin can sometimes metastasize only to osseous tissues. More than that, it has been noted that a total thyroidectomy generally performed in cases of malignant tumor can be followed by no severe signs of hypothyroidism because of the presence of osseous nodules of thyroid tissue, which not only reproduce the glandular structure of the organ but also elaborate the same specific secretion.

Such a property so marked in cancers of the thyroid has often been noted also in benign tumors of glandular types, in thyroid adenoma.

But it must be remembered how difficult the diagnosis can be, especially the histological one, between a thyroid adenocarcinoma and a simple adenoma, to understand why some authors have denied the existence of benign "metastasizing goiters" and have held the presence of metastasis as a sure proof of malignancy of the primary tumor.

The histological study is often performed on a single specimen of the removed tumor, while it is well known that evidence of malignancy can be found in a limited area; hence the necessity of examining many sections drawn from various places.

It is also well known that cases have been reported of secondary growths in bones in which the lesion was not to be considered either clinically or anatomically as a real thyroid neoplasm not even benign, but all characteristics led to the diagnosis of simple colloid or hypertrophic goiter.

Here I must emphasize the difficulty generally of distinguishing clinically rather than anatomically a simple hyperplastic goiter or often a hyperplastic and degenerative one from a thyroid adenoma.

Also we must remember that many authors have shown the possibility of a malignant change in a goiter limited to a small space of the enlarged gland. Therefore, thorough histological study is necessary, because this neoplastic area can easily be overlooked in an incomplete examination. There are in the literature reports of many cases of simple goiters with secondary reproductions in bones, and what is more important, with neoplastic development of these metastatic growths sometimes frankly malignant; while the primary enlargement of the thyroid gland appeared as a simple goiter or did not recur when operated upon.

Given the aforementioned difficulties of a sure diagnosis between a simple goiter and a benign tumor, we may take these cases into account together and study the possibility of metastasis in benign lesions of the thyroid gland (goiters and simple adenoma).

A lot of other cases that I will not enumerate have been published since Cohnheim reported the first case of multiple metastases to the lungs, bronchial lymph nodes, and bones. In his case the histological study of the enlarged thyroid showed a colloid goiter and a similar structure in the secondary growths

[1]Read before the Clinical Congress of the American College of Surgeons, Montreal, October, 1926.

Simpson (22) in a very interesting paper recently published gathers 77 such cases, but he also acknowledges that probably other cases have been reported which he has not seen. In a recent paper of mine (3) I think that I have succeeded in demonstrating that several cases which were reported as bone endothelioma were really secondary tumors of thyroid (or suprarenal) type, often with seemingly benign primary lesions of the gland.

Many hypotheses have been advanced to explain this behavior which does not conform to the accepted doctrines of the pathology of malignant as compared with benign tumors and with the simply hyperplastic or degenerative lesions such as the so-called goiter.

The theory accepted with most favor is that which seeks to prove the possibility of embryonal aberrations and of the formation of foci of thyroid tissue in abnormal sites. These at a certain time of life, generally more or less late, can give place to structures with a progressive development of neoplastic type. This theory, which is connected with that of Durante-Cohnheim on the origin of tumors in general, certainly applies to some common types in which localization of residual thyroid occurs. These are not always real embryonal aberrations, as for instance, tumors of the foramen cæcum of the tongue or in the lateral regions of the neck. Therefore the theory could be reserved to explain development in certain bones in the neighborhood of the neck, especially in the region of the lower jaw, and perhaps also in the region of the clavicle and of the sternum.

But it is difficult to accept this theory in case of multiple and distant localizations; more so as the relation of thyroid lesions such as adenoma or simple goiter to the evolution of these secondary nodules does not clearly appear. It would seem that in the postnatal life these secondary nodules would be entirely independent from the thyroid gland.

It must also be taken into account that tumors may develop in accessory thyroids and metastasize, because the primary tumor can be easily overlooked and the thyroid gland in its normal site shows no enlargement.

Honsell (9) denies the fact that accessory thyroids could give place to neoplasms, although I cannot understand the basis of such an assumption, because it is a generally accepted doctrine that neoplasms can easily arise in aberrant tissue; and as regards accessory thyroids there are the well studied cases reported by Barnabo (4) and Tron (23), and the cases reported by Lenzi and Martini (quoted by Barnabo) which deal with the development of simple goiters from accessory thyroids. Similar to these is Hollis' (8) case (after Henderson).

Accessory thyroid is to be found in the neck, at the base of the tongue, and in the mediastinum. The last two localizations are the most important as thyroid so placed is apt to be overlooked at a routine examination.

A typical case of adenocarcinoma developed from accessory thyroid with metastasis in the head of the humerus has been operated on by Ceci and reported by Saviozzi (19).

Another hypothesis seeks to prove that cells may enter the blood stream and become transplanted at distant sites in cases of both benign tumors and hyperplastic conditions of the thyroid. The theory is founded on the anatomical structure of the thyroid; especially on the close relations between the glandular tissue and the blood vessels and above all the veins, particularly in cases of hyperplasia of the gland. Hence, the easy growth of cells inside the vessel and the passage in the circulation of emboli, made up of masses of cells which can get to the right auricle, pass through the lungs, and dart into the main circulation. Oderfeld and Steinhaus' first paper (13) deals with this point. In the bone marrow they would stop because of the slowness of the circulation and grow by favorable not well defined conditions which can be inferred from the predilection of thyroid skeletal metastasis in malignant growths of the gland. In these new conditions of life, one must grant that these cellular complexes of benign neoplastic type or simply of hyperplastic type, could take an atypical progressive turn.

Pieri (16) writing about bone metastasis of thyroid cancer lays great stress upon the special type of lacunar circulation of the bones which leads to a lowering of the blood speed and favors the implantation of the circulating

Figs. 1 and 2, before operation, and Fig. 3, after operation, in Case 2.

cellular elements. He quotes Vanzetti (24) who, working on thyroid grafts, has shown that the most suitable ground for the development of thyroid tissue is the bone marrow. Joll (10) agrees with him and he refers to the observations of Piney (17) who compared the well formed blood vessels of the yellow marrow with the more numerous, thin walled capillaries of the red. He came to the conclusion that the cells or cellular masses tend to stop along the vessel walls as they pass from the circulation of the yellow marrow to the broader one of the red. The same thing happens under similar circumstances to the leucocytes.

In my paper on skeletal metastasis in hypernephroma I have noted that similar conditions in suprarenal tissue, in the capsule of the kidney, and in the aberrant nodules of the kidney support this hypothesis, which has been advanced to explain similar cases of osseous tumors with thyroid or suprarenal structure.

I do not wish to examine further these two hypotheses, but rather to consider the previously mentioned question of progressive and invading osseous thyroid tumors, sometimes several in number, with secondary metastases, and every evidence of malignancy but without a primary malignant tumor of the thyroid gland. Do they really exist or are the related cases simply errors resulting from excessive haste in reporting the case or incomplete examination of patients?

Simpson's already mentioned paper is worth reading in this connection. He upholds the opinion that these are malignant tumors not only with several cases gathered in the literature but also with 3 really demonstrative personal ones. The second of these had been reported in 1913 by de Nancrede as a case of metastasis of fetal thyroid tissue in the femur. Instead, Simpson has been able to prove that the patient died 18 months afterward owing to the rapid growth of an irregular, hard goiter, which infiltrated the neighboring neck tissues and caused progressive signs of dyspnœa, dysphagia, and aphonia; in other words death was certainly due to a carcinoma of the thyroid gland.

Quite similar to this is the case of thyroid tumor of the frontal bone reported by Oderfeld and Steinhaus; they thought it possible that normal thyroid cells had passed into the blood stream; but as it appears from a second paper by the same authors (14), within 6 months a local recurrence occurred, the right thyroid lobe had undergone considerable

Fig. 4. Photomicrograph, Case 2, showing round ovoid, or irregular cavities.

Fig. 5. Photomicrograph, Case 2, showing another area.

enlargement, and there appeared secondary nodes on the right temporal bone and on the sternum. Death ensued. A partial autopsy was done and it was recognized that the primary tumor was the one of the right thyroid lobe.

Simpson concludes that there is no such entity as the "benign metastasizing goiter" and that this term should be abandoned. I am able to report a case which has many points of similarity with the preceding ones and which can support this theory.

Case 1. T. A., a woman 41 years old, was operated on by myself in February, 1915. A right extracapsular hemithyroidectomy was done under the diagnosis of hyperplastic goiter. The right thyroid lobe had undergone an enlargement 3 years before.

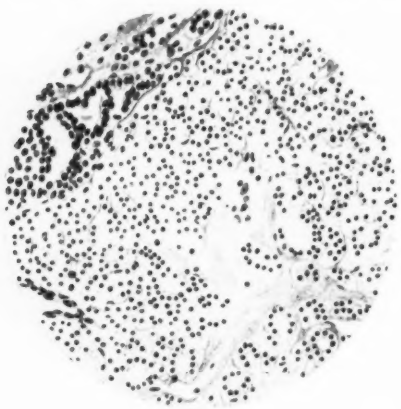

Fig. 6. Case 2.

A small portion of the superior lobe was left in place. The histological examination supported the clinical diagnosis. In 1918 the woman came to me complaining of severe pains in the upper portion of the right thigh. A diagnosis of sciatica had been made and various treatments tried without success. Clinical examination of the bone and hip joint were negative, but as the symptoms were not those of a usual sciatica and there was pain at pressure on the trochanter, I suggested a skiagram. This was done only after some time when while in bed the patient got a spontaneous fracture of the upper femoral end. The radiogram showed the neoplastic nature of the bone lesion. As clinical and radiological examinations were negative for other localizations, especially in the bones, lungs, and liver, in October, 1919, I resected the upper end of the right femur. Microscopic study of the tissue revealed an adenocarcinoma of the thyroid type. Convalescence was uneventful but within 1 year the patient experienced pains in the opposite side. Notwithstanding this she did well 3 years and with an orthopedic appliance she could walk. Death occurred in April, 1926, following local recurrence and metastasis. During all this time no suspicious nodules were detected in the right half of the neck, nor did anything noteworthy appear in the left lobe of the thyroid. In this case the microscopic study of the goiter removed in 1915 did not reveal any malignant structure; it agreed in this way with the clinical history of the patient and with the diagnosis. However, I must recognize the fact that the pathological examination was limited to the macroscopic appearance of the removed piece of tissue, to the raw cut surface, and but a few sections from a small area microscopically examined.

The further evolution—the metastatic growth in the upper end of the right femur, followed by spontaneous fracture and recurrence after resection, the development of other metastatic nodules which lead to death—gives great weight to the idea, although it is not certain, that the case was one of malignant

Fig. 7. Case 2.

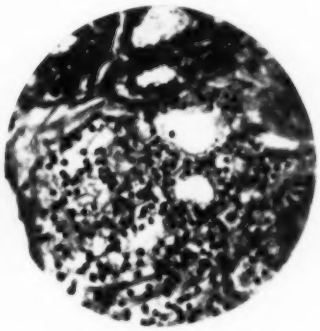

Fig. 8. Case 2.

primary neoplasm of the thyroid gland. The removed thyroid lobe was not preserved.

But it is not possible to explain in this way every case and I think the question not yet solved.

There are indeed cases in which no change of the thyroid gland is present, not the slightest enlargement (goiter); in these the exclusive explanation referring to a malignant primary tumor of the thyroid gland cannot be accepted.

I have observed and operated on 2 such cases, and from this point of view they look particularly interesting. Zapelloni (26) made a thorough search of the literature to 1913 and weighed every case with great care, excluding the simply doubtful ones. He collected 4 other cases, that of Riedel (18), lower jaw; Becker (5), clavicle; Serafini (21), upper jaw; and of Guibé (7), clavicle. To these I think that we ought perhaps to add Beilby's case, upper jaw, reported by Kanoky (11). Some of these cases, however, have been followed for a short time only.

I refer the reader to Zapelloni's paper for more details. I will confine myself to the report of my 2 cases because they have been followed up for a long time and studied from every point of view.

Both cases have already been published by D'Urso (6) who operated the first time on the first case, by myself (1, 2), and in the already mentioned paper by my assistant Zapelloni, who made a thorough histological study; so I shall add only a short résumé of the clinical histories together with the histological findings.

CASE 2. Q. A., from S. Donato (Caserta), male, laborer, married, with 7 sons, age 51 years in 1905. Personal and familial history irrelevant. He had malaria when 28 years old. Patient denies lues and venereal diseases.

In 1895 the patient fell on the right shoulder and within a year sustained another trauma of the same region, which was followed by a certain amount of limitation of motion of the right upper limb. In 1898 he fell again on the same shoulder, and an enlargement of the bone followed. For this he was admitted to the Surgical University Clinic. On physical examination a big tumor on the upper end of the right humerus extending to the insertion of the deltoid muscle was felt. It was in some places of elastic hardness, in others of elastic softness and there were places where it fluctuated, in other places egg-shell crackling was noted; it was pulsating on its antero-

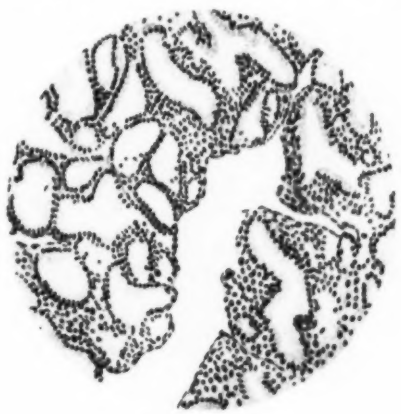

Fig. 9. Case 2.

external surface. Radiograms revealed a conspicuous enlargement of the head of the humerus and of the upper third of the diaphysis which below the insertions of the deltoid muscle appeared normal; the glenoid cavity and the other bones of the shoulder joint appeared normal.

Complete examination failed to reveal anything noteworthy. The thyroid gland was normal.

Under the diagnosis of myelogenous sarcoma of the upper end of the humerus a resection was performed by D'Urso on May 26, 1898. The patient did well for 21 months; in this time he noticed a knot as big as a nut deeply embedded in the soft parts near the humeral stump—a removal of it was suggested but as it did not give him any trouble, he refused. The node slowly and gradually increased in size until it invaded the whole posterior region of the arm and the axillary region. He then sought surgical aid and was admitted in my division in the Policlinic in April, 1905. He stated that recently the growth had increased more rapidly.

The biggest tumor (Figs. 1 and 2) occupied the upper portion of the arm and was connected with the humeral stump. It reached with a big irregular node the axilla, which was completely filled, and with other nodes not well defined, the pectoral, subspinous, and supraspinous muscles. The skin on the external and posterior surface of the arm and partly also on the external part of the scapular region was dark red and bruised, because of the undergrowing tumor and ointments used by the patient. The anterior surface of the arm and the chest was normal; only many conspicuously enlarged subcutaneous venous vessels could be seen.

The whole mass was soft, and in some places fluctuated; the surface was irregular and pressure did not elicit any pain, it was not pulsating. Because of the impossibility of examining the arm pit no enlarged lymph nodes could be noted in the subclavicular and supraclavicular region, or in the lateral chest wall. No active motion was present, but a certain degree of passive motion was possible. The scapula was felt following the movements of the limb. Complete examination did not reveal anything noteworthy. The lungs were normal. The thyroid gland was perfectly normal.

As a simple removal of the growth was impossible I performed April 8, 1905, an interscapular thoracic disarticulation. The postoperative course was uneventful (Fig. 3). After 1 year I saw the patient again. There were no recurrences; the thyroid gland was always quite normal. I have not been able to follow up this patient.

A particular microscopic and macroscopic description of the tumor removed in 1898 by D'Urso can be found in D'Urso's paper published in 1900. I refer the reader to it. He thought at the time that the tumor was a lymphangio-endothelioma.

Zapelloni has given a minute account of the piece that I removed, and to this also I refer the reader. The tumor was composed of various nodes, some very big. One was as big as a cedar fruit and was embedded between the vastus externus and internus of the triceps and the long head of this same muscle. Others were the size of an almond, or still smaller; one was closely adherent to the shaft of the humerus, which was at this point invaded by the tumor and fractured.

Generally speaking the nodules were more or less round shaped, with a coarsely lumpy surface, and well limited by a capsule, so that each mass could easily be enucleated from the neighboring tissues. The capsule was of varying thickness, pinkish where it was thicker; dark red or dark green where it was thinner and the tissue underneath could be seen. The masses were soft, somewhat fluctuating. On section the structure was cystic and nodular; the cysts were of various size, some scarcely visible to the naked eye, others almond sized. Some were filled with dark, non-glutinous, homogeneous, jelly-like substance, others with similar material but reddish or greenish. The nodules were also of different size, but were rather horny of variable color from yellow pink to yellow brown. The cysts and the nodules were separated from each other by a net of connective tissue which originated in the capsule. In the center of the biggest masses a strand could be seen passing directly into the surrounding neoplastic tissue. It had a glassy appearance and was firmer because it did not contain cystic cavities.

Microscopically the tumor was composed of two different tissues, the first vesicular, tubular, or alveolar, with a colloid secretion inside most of the vesicles and tubules; the cavities were lined with cuboid or cylindrical rather small cells; these had a dark protoplasm and were arranged as an epithelium. The second was tubular or alveolar, and had no colloid secretion and its cells were larger, polyhedral, or cylindrical, with a light protoplasm. They were also arranged as an epithelium.

The former type was more widely scattered and was made up of round shaped, ovoid, or irregular cavities; these were lined by a layer of generally dark elements and were filled with a homogeneous, notched, structureless mass, which took different colors with different dyes, pink with the eosin, red with the scarlet, yellow with the Van Gieson's, orange-reddish with Mallory's, bright red with Traina's dye (Fig. 4). In another area the structure was somewhat different as the vesicles were gathered around a blood vessel with their greater axis normally to it, in such a way that in some places thin connective tissue septa could be seen proceeding from the outer coat of a transversely sectioned vessel and making a network with more or less triangular meshes each one holding a vesicle (Fig. 5). In other places these dark cellular elements were arranged so as to form tubular, or band-like structures, anastomosed between themselves sometimes with an irregular opening, or so as to form alveolar structures as cellular nests of a connective tissue network.

The latter type of tissue with its light, polyhedral elements has a tubular or an alveolar structure. It

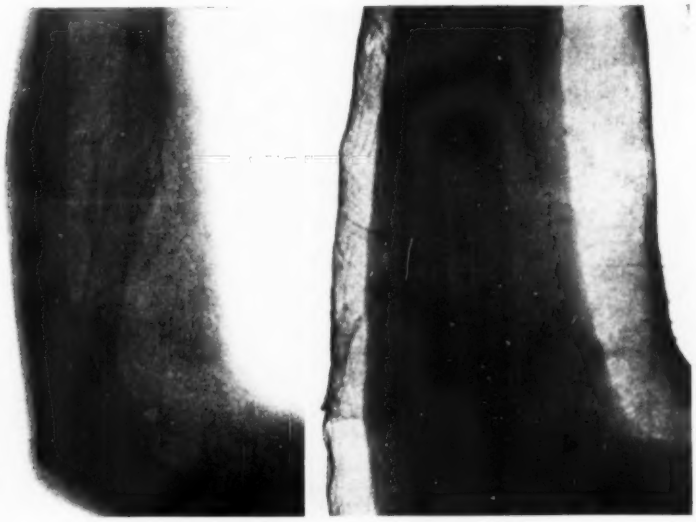

Fig. 10 (left). Roentgenogram of the neoplasm in Case 3.
Fig. 11. Roentgenogram 20 days after operation.

is characterized by the thinness of its connective tissue fibers and by its supply of broad and varicose capillaries. In some places we found thick strands of polyhedric, light cells, separated by thin connective tissue septa, or by a capillary vessel, often anastomosed to each other.

In the strands the cells were directly and irregularly placed one against another; only a few areas were to be seen where the cells took a sort of columnar disposition with the nuclei displaced toward the axis of the strand (Figs. 6 and 7). Along the axis of the broadest strands there were often rather cylindrical cells circularly placed around a small space so as to form a vesicle which was not surrounded by any membrane. There were also broad tubules lined by a single layer of high columnar light cells (Figs. 8 and 9) which on transverse or oblique section had the appearance of vesicular structures. These regularly bored tubules (100 micromillimeters) had a tortuous course and twisted themselves together and formed a compact mass divided into irregular lobules by vessels and connective tissue bands.

The cysts visible to the naked eye were partly hæmatic with a connective tissue wall, partly filled with an amorphous and microchemically colloid-like substance, like that found in the microscopic vesicles. In these an epithelial lining more or less preserved was found. The cells were those of the dark type only more flattened in places, pluristratified, with shallow intracystic papillary growth.

From this description, it can be seen that the first type of tissue, where it has a vesicular structure, perfectly imitates the thyroid tissue in its monostratified epithelial lining of the vesicles and in the irregularly edged, microchemically colloid-like substance which fills them. In the different fields it looks like embryonal thyroid tissue, like adult gland, thyroid adenoma, and also like thyroid carcinoma.

The other type, especially in its alveolar areas with irregularly polyhedral neatly defined cells whose central well eosin-stained nuclei have plenty of chromatin, imitates the corticosuprarenal element, and still more the fundamental element of the parathyroid glands.

The behavior of the elements between these cells, the connective tissue, the vessels, and many other features, which are discussed at length in Zapelloni's paper, and above all the close contiguity to thyroid tissue, all lead to the conclusion that these areas represent a tissue of parathyroid type.

Hence the histological diagnosis of mixed thyroid and parathyroid adenocarcinoma.

Case 3. B. M., age 21 years (in 1912), was a student from Rome. The familial anamnesis was irrelevant. The patient had had when young, typhus, bronchitis, and scarlet fever, and afterward had always enjoyed good health until September, 1910. At this time he began to complain of sharp, shooting pains in the right forearm; the supination and pronation of the forearm sharpened the pain to such a point that these movements were very limited. When the pains subsided a feeling of weakness followed. Physical examination was negative. No fever occurred. These conditions lasted from September to December, then the symptoms disappeared and the patient did well until September,

Fig. 12 (left). Roentgenogram 224 days after operation.
Fig. 13. Roentgenogram 19 months after operation.

1911, when he began again to complain of the pains and of irregularly remittent fever. This time there was a widely spread œdema of the right forearm while a circumscribed mass on the radial side of the limb on the middle third could be felt. He was then treated with rest, heat, injections of iodine and mercury without success. In January, 1912, the patient entered my division.

On the middle third of the right forearm a mass could be felt which bulged on the anterior and posterior surfaces of the limb while the medial and external faces were almost normal. The mass was firmly adherent to the middle part of the shaft of the radius and it was more prominent forward than behind a little rather externally. The consistency varied; in places it was bony hard, in others elastic or fibrous. The mass was not pulsating, pressure was not painful. There was a slight limitation of pronation and supination. No palpable lymph glands were felt at the epitrochlea or in the axilla; the thorax was quite normal. Radiograms revealed a rarefaction, swelling, and an irregular structure of the middle part of the radius shaft, and the cortex with the medullary canal were caught in the process (Fig. 10). Below, a fairly long piece of the shaft was uninjured; but above, the process reached a level as high as the tubercle of the biceps muscle. Fluoroscopic examination of the thorax was negative. The rest of the history of the case is irrelevant.

Under the diagnosis of sarcoma of the right radius shaft, I resected on February, 1912, the invaded segment of bone and put in its place a graft from the right fibular shaft. Uneventful recovery followed. I shall speak afterward of the microscopic and macroscopic examination of the tumor.

I think it interesting to remember that the patient did well for nearly 2 years. During this period the function of the right upper limb was good. A fibular graft had been substituted for the radial shaft, the lower right limb having been deprived entirely of its fibular shaft. The graft was perfectly soldered with both stumps of the resected radius and had gradually changed to what looked, in the radiograms like a normal radius (Figs. 11, 12 and 13).

The patient came to me again in 1914. He had developed a local recurrence of the tumor on the inferior radial stump. In February, 1914, I resected the whole inferior end of the radius, disarticulating it from the carpal bones; I grafted in its place a splint from the other fibula (left) which I implanted into the scaphoid at one end and the other Z-shaped end I fastened above with a Putti band. The immediate result was good, although not so good as after the first operation. However, it lasted but a short time, because the patient soon developed another local recurrence followed by metastases in the occipital and parietal bones and in the lower dorsal vertebræ. They grew rather fast, especially the cranial metastases and became the source of sharp pains. Pulmonary symptoms occurred, followed by rapid emaciation and death, August 25, 1916, 4½ years after the first operation.

In all this long time the thyroid gland revealed no change in size, nothing abnormal was to be noted in the neck or in the neighboring regions; there were no symptoms to call attention to the gland.

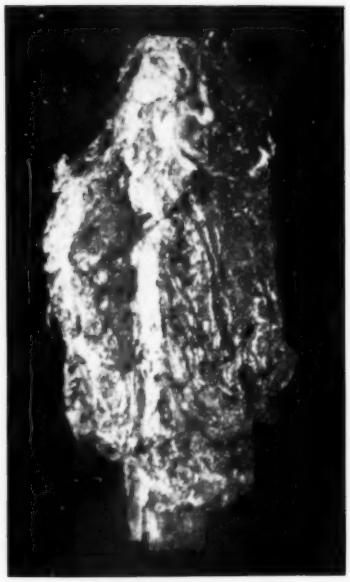

Fig. 14. Gross specimen.

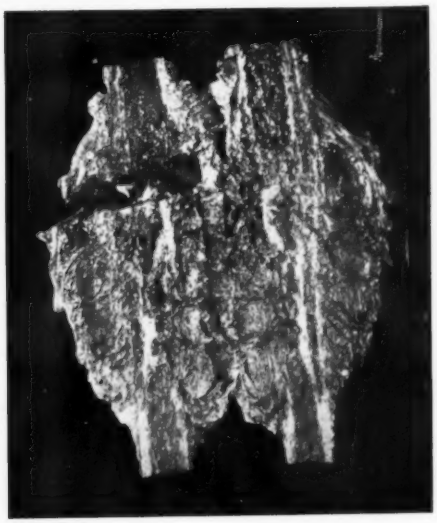

Fig. 15. Longitudinal section of specimen.

The specimen removed at the first operation included 11.5 centimeters of the radial shaft; above and below, the bone and periosteum which covers it for 1.5 centimeters looked quite normal. The intervening part between these two was composed of a spindle shaped irregularly laterally flattened mass; it had a major anteroposterior diameter of 7.0 centimeters and a lesser laterolateral one of 3.5 centimeters. The two lateral edges of the radius appeared nearly normal, while the anterior and posterior surfaces were each covered with a mass the shape of half a spindle (Fig. 14).

Each one of these two masses had a lumpy surface, the various lumps were separated by grooves and had different color and consistency. Some were very dark, nearly black; others reddish, pink whitish, while some were rather soft, others were hard or elastic. There were no places where egg-shell crackling was to be felt. Near both ends of the mass one could feel deeply a roughness as of bony particles.

The tumor was sawed longitudinally in an anteroposterior division and in its axis the bone tissue of the radius could be recognized (Figs. 15).

At both free ends the radius presented a broad medullary cavity limited by a thin but ivory-like cortex; but while on the anterior surface of the bone this could be followed from one end to the other, on the posterior surface it lost itself in the tumor. Along the whole neoplastic mass there was no medullary cavity; there were instead many strong bony strands with a prevailing longitudinal course, uniting with each other.

All along the radius in the sawed piece the neoplastic mass looked like two caps put on the bone and firmly adherent to it. Toward the external side the mass was encapsulated by a connective tissue which in some places was not well defined from the surrounding tissues. Connective tissue septa radiated obliquely above and below from the middle part of the external surface of the bone to the internal surface of the capsule. They corresponded to the aforementioned grooves on the surface of the tumor. In this way, irregular areas of varied sizes were formed filled with a parenchymatous tissue, in some places reddish and soft, in others brown and firmer. This neatly lobulated structure was more evident in the anterior half. The posterior one was more irregular and toward the bone was formed by plenty of bony trabeculæ between which the neoplastic mass reached the center of the bone and filled the medullary cavity

Specimens for microscopical examination were taken from several places. When decalcified and differently stained, they revealed different structures in the reddish and in the brown parts.

In the reddish part and in the smaller nodules (Fig. 16), very small cavities whose walls were embedded in the connective tissue were lined by a single layer of cubical cells. There were places where the connective tissue bulged like a bud inside the cavity. It divided itself into many branches all coated by the aforementioned cubical cells (Fig. 17). These elements were all alike, small, with an ovoid, big, deeply stained nucleus having a single

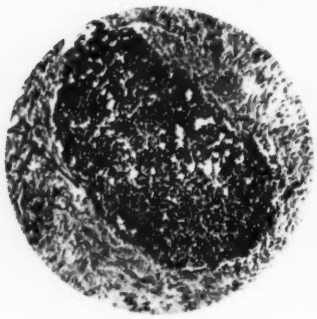

Fig. 16.

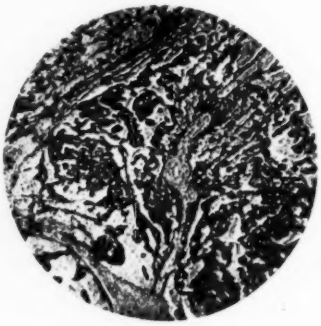

Fig. 17.

nucleolus. Their cytoplasm was scanty, apparently homogeneous, well stainable. The divisions between the cellular bodies were not very clear. They were generally disposed in one layer, very seldom in two or three. The connective tissue and the papillary structures looked young with a plentiful supply of blood vessels.

In other points, especially at the outer border of the neoplastic masses there were still simpler structures which, however, were of the same general character as those already described.

Also in the larger nodules we found round cavities lined by the epithelial layer. They had papillary proliferations with a blood vessel in the axis coming off the wall. In the microscopic field they appeared to be composed of a transversely sectioned blood vessel. Around it there was a halo of young connective tissue coated by epithelial elements (Fig. 18). It could be recognized, because the larger nodules were composed of several minor ones blended together and indeed one could still recognize connective tissue septa with small arteries and veins running in the depth of the nodule (Fig. 19).

Fig. 18.

The big brown nodules presented a different aspect. We found in them among a rich connective stroma, round or ovoid cavities lined by big cubic or columnar epithelial cells and filled with a spinous edged substance without structure (Fig. 20). These cavities had a very variable shape and size; in the small ones the lining cells were rather flattened. In the bigger ones they were frankly cubic or columnar. They had well defined borders, uniformly granulous cystoplasm with a condensed superior edge, big, rather basal round shaped nucleus, a well-evident membrane, a scanty chromatic network, and one or two big nucleoli (Fig. 21).

There were also other elements among these, which were narrower, with a more deeply stained cystoplasm, and smaller nucleus. Mitotic figures were also present.

The homogeneous substance which filled the cavities could be stained yellow with van Gieson's dye, orange with Mallory's, bright red with Traina's (Figs. 22, 23 and 24).

For other although interesting histological details in connection with the stroma, the relations between the stroma and the follicles, the bone marrow in place of which neoplastic tissue was to be found, and the relations of this tissue with the soft surrounding parts, I refer the reader to Zapelloni's paper.

From this brief description of the preparations, and from the figures, it clearly appears that we have to deal with a thyroid tissue especially in the brown areas of the tumor; while in the reddish areas the papilliferous type is evident, and at least after the studies of Langhan's and Getzowa's work we can believe that we are dealing with proliferations of the elements of the thyroglossal duct and of the lower entodermic branchial pouch.

The tumor can then be defined as vesicular and microcystic papilliferous adenocarcinoma of the thyroid type.

There is scarcely any doubt that the tumors in question were skeletal, thyroid tumors (upper end of the humerus in the first case,

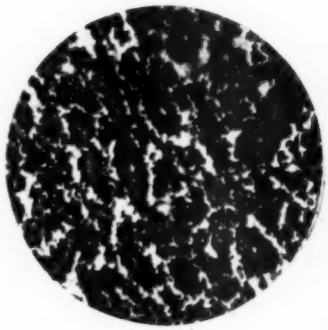

Fig. 19.

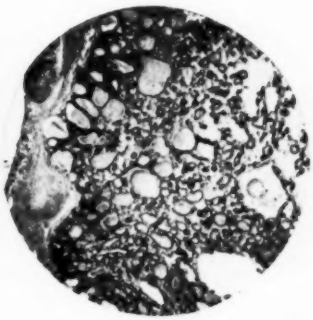

Fig. 20.

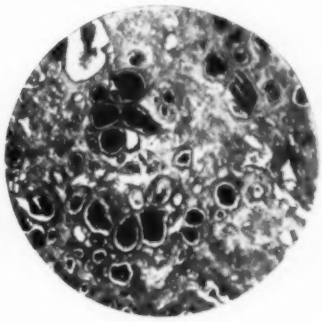

Fig. 21.

radius shaft in the second) with progressive course, local recurrences, and with multiple metastases in the second case. These characteristics confirmed the diagnosis of malignancy.

I think that there can be no doubt that in the first case the neoplastic tissue was not only clearly thyroid, but also parathyroid in type. Although the description of the microscopic examination has been shortened, together with the pictures it is quite clear.

I consider these 2 cases so important and have reported them because the thyroid gland did not show even the slightest change or enlargement before the onset of the skeletal growth, during its development, nor after the operations, which in both cases had to be repeated because of recurrences. Nothing which could possibly represent the primary site of an eventual tumor whence the metastases might have proceeded could be detected in the regions of the neck, of the tongue, or in the mediastinum where aberrant thyroid glands are usually found.

In the first case, a man 51 years old, D'Urso operated with the diagnosis of sarcoma of the head of the humerus and thought afterward that the tumor was an endothelioma; now it can be objected that he did not examine with great care the thyroid gland and its neighboring regions. But after 7 years when I performed the interscapulothoracic disarticulation I was not able to find anything even suspicious; and after another year when I saw the patient he was still free from recurrences and the structures of the neck were quite normal. As I have said, I have not been able to follow this patient up and I cannot give further information about the course of the disease. But during the 8½ years after the apparent onset of the lesion and the 8 years after the first removal of the thyroid bone tumor, the patient underwent many examinations and it can be stated that in this long time no changes could be found in the thyroid gland.

I think the second case also typical. Microscopic examinations after the first operation proved the thyroid nature of the radial growth and although careful examinations were made we could detect no changes at all in the thyroid gland nor the presence of other structures which could be interpreted as normal or enlarged accessory thyroid glands.

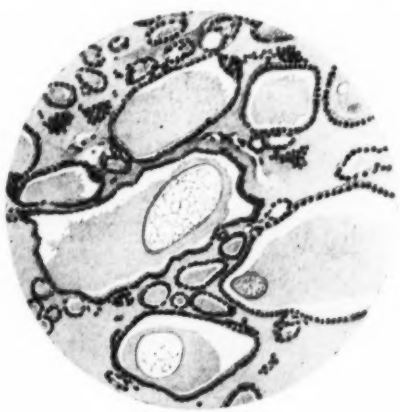

Fig. 22.

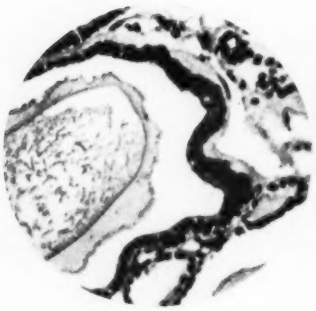

Fig. 23.

Fig. 24.

Zapelloni in his paper (1913) emphasized the perfect integrity of the thyroid gland 2½ years after the onset of the bone lesion and 14 months after the operation. And the already reported further course of this case with its second operation for local recurrence and its metastases in the cranial bones and in the vertebral column, which I followed to the death of the young man, allows me to state that during all this time (6 years after the apparent onset of the radial lesion, and 4½ years after the first operation) I saw nothing abnormal, even with the most careful and minute examination, in the thyroid body nor in the neck and neighboring regions.

I do not think it possible that even a small primary neoplasm which ought to be anterior to osseous localizations could be present for 8½ years in one case and 6 years in another without revealing itself.

And if this statement cannot, as it looks to me, be denied, it is not a question of benign metastasizing goiter. Therefore Simpson seems to be correct in his opinion that it does not exist or is a very doubtful entity, because of the great clinical and microscopic similarity between simple goiters and malignant thyroid tumors. But we are compelled to admit that osseous tumors of thyroid or parathyroid type can be found without any primary lesion of the normal or accessory thyroid gland.

In these cases of seemingly perfect integrity of the thyroid gland, as I have already said in speaking about the goiters and the benign tumors, we cannot offer any other explanation than one of the following two:

1. These growths may proceed from aberrant embryonic germs. This explanation is the one expressed by Zapelloni in the discussion of the 2 cases and by Verga (25) in a case of similar growths of suprarenal type.

2. Normal cellular elements may be conveyed to distant places, and in their new site, for unknown reasons, can grow in an atypical way. This possibility was observed by Gaylord in fishes; by Riedel and Oderfeld and Steinhaus in thyroid tissue; and by Pick (15) and Manasse (12) in suprarenal tissue.

I have already pointed out that it is not easy to explain with the first hypothesis the metastases far from the neck and from the complex mesobranchial structures which though not frequently have been observed in some cases.

The findings of my first case apparently disprove the second hypothesis; indeed, the simultaneous presence of thyroid and parathyroid tissue, if it can be explained as an embryonic aberration of neighboring tissue growth during the complex work of development, can not be thought of as an embolism of normal elements of different tissues at the same site. This looks to me like a very strong objection. I should rather incline toward the former explanation; but the question is a very difficult one, and I think can not be solved by us, engaged more on the clinical side of it. I leave it to be solved by the especially competent pathologists.

I have reported my cases because of the thoroughness of the study and the long time they have been followed up. I wish only to add in conclusion that the presence of thyroid and parathyroid tissue in the tumor of my first case seems especially important because not only is it very improbable that normal cells of different although neighboring organs were conveyed to a distant site but above all the presence of even a small, not easily detectable tumor seemed unlikely. Indeed we would have to believe, according to this hypothesis, that this small neoplastic primary nodule was not only composed of two different tissues both with a neoplastic value, but that both at the same time had metastasized to the same site.

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MULTIPLE CARTILAGINOUS EXOSTOSES—DIAPHYSEAL ACLASIS

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THE writer wishes to record 6 cases of multiple cartilaginous exostoses and to call attention to the similarity between that condition and chondrogenesis imperfecta or achóndroplasia. There are over 600 cases on record. The first case reported in America was by Gibney in 1875. Sir James Paget described the condition in 1853. It is stated that it was first recognized by Hawkins in 1839 and the first complete study was made by Ollier in 1899.

In the present series, this condition has been noted at as early an age as 5 months, as in Case 1. Children have been born with exostoses present. Males predominate in the ratio of about 3 to 1. This ratio is probably due to the increased risk of trauma in the male. Heredity is definitely established. The condition is rare in the colored race. Retarded puberty has been noted repeatedly, and this fact together with the frequent disappearance of the exostoses at puberty have been offered as proof of a glandular etiology. Keith believes that the condition of multiple cartilaginous exostoses is related to achondroplasia and may be due to a disturbance of function of the glands of internal secretion, most likely of the thyroid.

Virchow believed the exostoses develop from splintering off of the growing cartilage in intra-uterine or extra-uterine life. Voorhoeve believes there is a transitional stage between cartilaginous dysplasia and the condensing bone affection known as Albers-Schoenberg's *Marmorknochen*. Renfrew White recently described two cases of multiple exostoses and of chondrodystrophia fetalis and remarked on the similarity in clinical appearance as contrasted with the absolutely dissimilar nature of the defect in bone development.

Wladimir Ulrich states that cartilaginous exostoses develop as an achondroplasia, are developmental, and have their origin in the organs which influence bone growth, namely the glands of internal secretion. He states that the true cause is unknown but probably lies in a series of disturbances which may appear in one case as rickets, in another as multiple exostoses, and at a more advanced age as arthritis deformans. The reader is advised to read the excellent monograph by Rischbieth and Barrington.

In an admirable paper by Sir Arthur Keith, a very suggestive new theory of pathogenesis is presented. This writer states that the condition of exostoses should be taken out of the category of bone tumors and placed among the disorders of growth, and because it is a disturbance of the modeling or pruning of the diaphyses, he proposes the name of "diaphyseal aclasis."

He reviews some work of Hunter's stating: "One of John Hunter's more important discoveries was his realisation that the shafts of bones grew in length by a double process; there was first the deposition of new bone in the cartilaginous growth disc at the ends of the shaft, a process clearly recognized before Hunter's time; there was in the second place a 'modelling process' by which the new bone thus laid down was pruned, reformed and incorporated as an intrinsic architectural part of the cylindrical shaft. Hunter clearly recognized that these two processes were independent operations. If Hunter's teaching is true, then we ought to find disorders of growth in which deposition of new bone goes on while the second or remodelling process is retarded or even completely arrested. A survey of the skiagraphs of the first case of multiple exostoses that came my way showed me that in this disorder the deposition process goes on but the modelling process is retarded and aberrant. In multiple exostoses, which is a disorder of youth and of adolescence, then, the modelling process is profoundly retarded; in some instances almost arrested. The bony excrescences or tumors, which serve as diagnostic marks for the clinical recognition of the condition, are merely secondary results

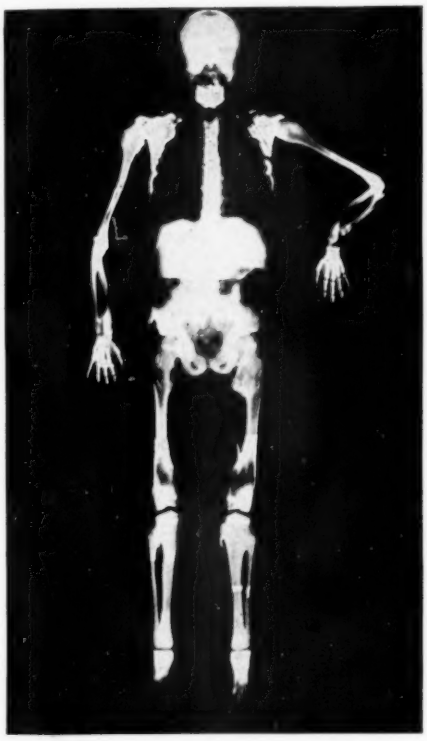


Fig. 1. Composite roentgenogram of Case 1.

of the primary disorder of growth for which I propose the name of 'diaphyseal aclasis.'" Keith states that about half the subjects of this condition gave a history of one or more

Fig. 2. Case 1 showing bowing of left forearm and exostosis below left knee.

relatives similarly affected and that the disorder is Mendelian in its incidence.

The disturbance is confined to those elements of the skeleton in which bone laid down within cartilage comes to be covered by periosteal bone, as in the shafts of the long bones. Hence this disorder of growth occurs in the growing ends of the shafts of long bones where a core of bone formed within cartilage comes to be encased in a sheath of bone formed beneath periosteum. Where growth is most marked and most prolonged, as at the distal and proximal ends of the femur, tibia, and fibula, at the distal ends of

Fig. 3. Left forearm of Case 1. Note disturbed relations of elbow joint structures.

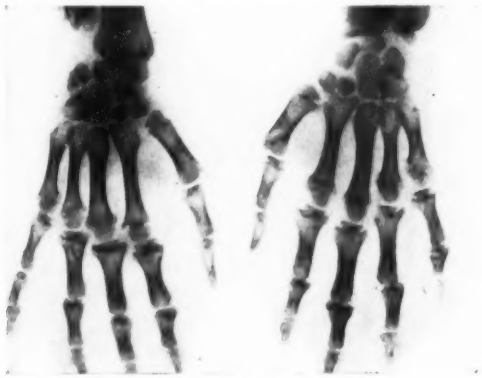
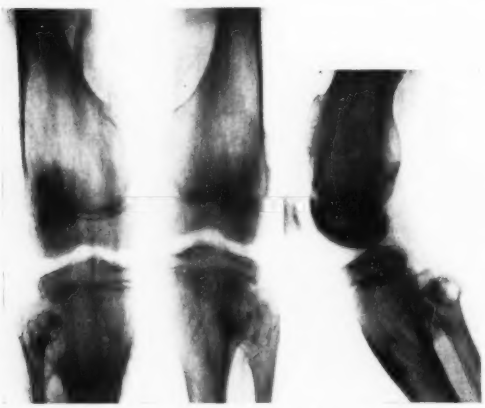


Fig. 4. Hands of Case 1.

Fig. 5. Right shoulder region of Case 1 showing exostosis of scapula.

the bones of the forearm and at the proximal ends of the humerus, the aclastic condition is most marked. It is also particularly well seen at the growth line along the vertebral border of the scapula, and along the cristal border of the ilium. The outer and inner ends of the clavicle being formed from both cartilage and membrane, also show an unmodeled formation.

Storey's patient had a brother and 4 maternal uncles who were affected with the same disorder. Percy reported that in a family of 4 generations in which 113 persons were investigated 26 were affected; 22 were males and 4 females. Reinecke traced 172 cases in 36 families.



Figs. 7 and 8. Anteroposterior and lateral views of knee region of Case 1.

Fig. 6. Pelvis and hips of Case 1.

In an attempt to determine the bone changes, Keith superimposed the tracings made when a girl of 16 was first observed and those made 10 months later, and made accurate observations. He states that all bones formed entirely within cartilage are free from any disorder of growth. The tarsal and carpal bones, the epiphyses of all the long bones, the vertebral bodies and sternum are formed in aclastic individuals as in normal persons. Likewise are the bones formed in membrane—the bones of the cranial vault and of the face.

The exostoses occur at the epiphyseal ends of the long bones, especially the tibia and femur at the knee.

The various types of exostoses are spinous, sessile, pedunculated, oblique, and straight. The associated pathology consists of limitation of joint motion, bursitis, periosteitis, and fracture with pseudarthrosis. Mosenthin re-

Fig. 9. Feet of Case 1.

Fig. 10. Lateral view of one foot of Case 1.

ported a case of aneurysm of the popliteal artery due to irritation of an exostosis. Ochsner and Rothstein reported a case of exostoses within the spinal canal.

The most prominent findings are the exostoses. These are usually painless unless traumatized or subjected to pressure by neighboring structures. During a period of rapid growth they may be tender or sensitive. Swelling is usually easily seen. Deformity due to curvature of bone may be produced especially in the forearm or leg. When two long bones are parallel and connected by an interosseous membrane, unequal growth in bone will result in deformity. In the forearm there is produced a manus varus or manus valgus, depending upon the bone affected. The exostosis may interfere with the function of the muscles, tendons, or joint. Injury to the exostosis may result in bruising, fracture, or hæmatoma formation. Bursitis may result from trauma to the exostosis. Associated symptoms may be of a glandular nature such as the delayed sex growth noted in Case 1. Many of these patients are below the normal in muscle power.

The diagnosis is based upon the history, the findings, the exostoses, and the roentgenograms. The differential diagnosis between osteitis fibrosa cystica, cysts of the long bones, and other bone tumors should be made easily.

Fig. 11. Case 2 similar to achondroplasia.

Fig. 12. Case 7, hypertrophic chondrodystrophy.

Fig. 5. Right shoulder region of Case 1 showing exostosis of scapula.

Fig. 6. Pelvis and hips of Case 1.

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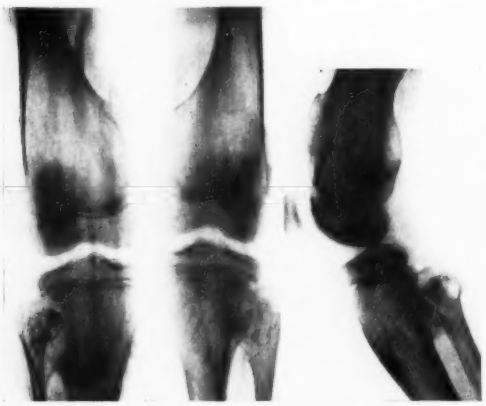

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Fig. 11. Case 2 similar to achondroplasia.

Fig. 12. Case 7, hypertrophic chondrodystrophy.

Fig. 13. True achondroplasia.

Fig. 15. True achondroplasia.

Fig. 16. Pseudo-achondroplasia.

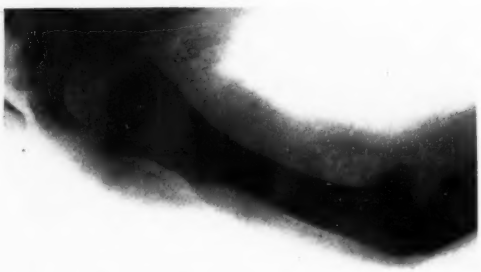

Fig. 14. Roentgenogram of Figure 13 illustrating epiphyseal changes in achondroplasia.

The prognosis concerns chiefly the question of malignancy from chronic irritation. A malignant enchondroma might result.

As in Case 1, some of the exostoses might disappear. In this case, the original growth has entirely disappeared.

The non-surgical treatment consists of protection of the exostoses from injury which might result in periosteitis or fracture. The surgical removal of the exostoses is indicated under several conditions, that is, excessive size, interference with the function of a joint, a muscle or a tendon, pressure symptoms, sensitiveness of the exostoses, and repeated trauma which might result in malignant degeneration or fracture. Removal of the cartilaginous cap must be complete. If correction of the deformity is indicated, as in Case 1, osteotomy of the forearm is advisable.

CASE REPORTS

CASE 1. E. H., male, 12 years old, born in Leeds, South Dakota, son of a physician, was referred by Dr. Vander Mark. He is the second of 3 children. His mother was in labor 3 hours. He was apparently a normal baby and was breast-fed for 5 months, when a complementary feeding was used. He had a tooth at 6½ months, and walked at 1 year. There is no family history of similar trouble.

The first symptom at the age of 5 months was a small mass on the left forearm. This mass has since disappeared. At various intervals new exostoses appeared on practically all of the large long bones, the only one causing trouble being the one above the left wrist which has produced a curvature of the forearm. The masses, about 50 in number, caused no pain. The only other point of possible interest in the history is that the boy "likes to chew gristle."

CASE 2. M.D., a girl 1 year of age, was referred by Dr. D. H. Levinthal. The case is one of mild though typical achondroplasia.

CASE 3. A.B., a soldier at Camp Grant, Illinois, was referred by Dr. Lester Palmer.

CASE 4. M.S., was the wife of a U. S. colonel and patient of Drs. A. R. Elliott, John Ridlon, and J. L. Porter.

CASE 5. J.S., was the son of the patient in Case 4, and a patient of Dr. John Ridlon.

CASE 6. C.D., a colored girl of 14 years, seen at the St. Luke's Hospital outpatient department, was probably a case of true hypertrophic chondrodystrophy.

SUMMARY AND CONCLUSIONS

Hereditary deforming chondrodysplasia or multiple cartilaginous exostoses, to which condition Keith has given the name of "diaphyseal aclasis" or failure of the diaphysis to shape itself normally, is manifested by multiple painless exostoses occurring chiefly at the epiphyseal ends of the long bones especially in the region of the knee joint. They may be found at birth but more commonly during young childhood. Occasionally they disappear spontaneously. They are benign and only infrequently require surgical treatment. The writer believes that multiple cartilaginous exostoses and achondroplasia have many points in common and possibly a related etiology.

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OSTEITIS DEFORMANS

By WILLARD VAN HAZEL, M.D., and EDMUND ANDREWS, M.D., F.A.C.S., Chicago
From the Department of Surgery, University of Illinois

PAGET'S disease of bone was first described in 1877 by the one whose name it bears. Osteitis deformans was the descriptive name used by the author in his original report of 5 cases, which still remains as the greater part of the sum total of our knowledge of this affection. Later he added 7 cases to this and by 1889 had seen 23 cases.

FREQUENCY

Since 1889 cases have been reported from time to time, Lewin in 1925 collecting 251 from the literature, which suggests that it may rightfully be termed a rare disease of bones. Undoubtedly many cases occur which are unrecognized. In the large hospitals we find Hurwitz recounting 3 cases in 30,000 medical admissions to the Johns Hopkins Hospital; Carman and Carrick, 15 in 237,000 admissions to the Mayo Clinic over a period of 6 years; Da Costa, Funk, and others, 13 in 38,000 admissions to Jefferson Hospital; Cutler, 7 cases in 285,000 out-patient admissions to the Massachusetts General Hospital in 12 years.

The most frequent site of the malady is in the tibiæ, femora, the vault of the skull, pelvis, spine, and clavicles. The ribs, ulnæ, radii, jaw, and metacarpals have been affected in some instances. When the lesions occur in the long bones, they are more often symmetrical and this generalized manifestation is by all odds the more common.

In 1883 Bowlby first called attention to one bone involvement. A cab man who had been injured came to autopsy with the findings of osteitis deformans in the right femur alone, a condition which was known to have existed for 10 years. The course of the disease is prolonged; and some may offer the criticism that the one bone type is an early stage. However, in some well authenticated cases, years have passed with no changes elsewhere. Hurwitz and Carr in 1914, reported 7 cases and added another of one bone involvement. Newton last year collected 5 more to which he added 3. Among the latter, Romer had 3 patients, all with a history of trauma, while Newton could find no trauma playing a possible part in his 3 cases. Trauma, however, has been elicited in the history more often in the one bone type. In one of Newton's cases the disease was stationary for 3 years. Cone observed a patient for 10 years with the disease localized in the right femur; and Ely described the bone from a patient whose right femur alone had been affected for 30 years.

ETIOLOGY

The suggestion, made in the earlier writings that lues is a possible cause has not been sustained and in all likelihood lues bears no relationship to the condition. Da Costa states that four-fifths of the cases show a negative Wassermann; and a positive Wassermann has not been seen in uncomplicated cases. He does not agree with some that it is a latent manifestation of inherited syphilis.

Trauma to the part involved is noted quite frequently, particularly in the one bone manifestation of the disease, and is believed by some to be a factor. The history of trauma, however, is seen to occur in some shortly before the onset of symptoms while in others years have elapsed. In our patient slight injury occurred 1 month prior to bowing. It seems quite doubtful whether trauma is to be considered seriously as a causative factor. Leri reports trauma 8 months before involvement of the humerus. Perhaps injury calls attention to the disease that is already present; when years have elapsed it is probably simply coincidental.

The trophic theory, cited by Prince and others, gives a neurological basis to the disease, as seen in tabes and syringomyelia. Prince reports nerve or cord changes in 6 out of 10 cases. Packard with others maintains that no cord or nerve changes occur and quotes a similar view by Von Recklinghausen.

In the search for the cause of the disease, bacteriology has not been overlooked. Da Costa credits Italian investigators, Archangeli,

Fig. 1. This area shows considerable bone destruction, the giant cells or osteoclasts are numerous and are seen in some instances to give an eaten out appearance to the adjacent bone. The osteoclasts give the suggestion of occupying a niche.

Fig. 2. This section shows what might be termed a stage of healing. The osteoid tissue filling the marrow spaces is a vascular fibrous tissue. Some spaces are lined by osteoblasts while others are crowded with them. Giant cells are less numerous than in Figure 1.

Fiocca, and Morpurgo, with the claim that an organism has been cultured from pagetic bone, the nature of which was a diplococcus. A vaccine made from the recovered organism, was reported to be of value in the treatment. The work on this phase has not been extensive and Ellis was unable to obtain any organism in 2 cases from which bone had been removed from the tibia.

The assumption of a disturbed metabolism has given rise to considerable work. Believing a continued toxic basis due to disordered metabolism may give rise to the bone changes has led to investigation in this field. The parathyroids have been reported to be the seat of adenomata in the disease. Collip and his workers have shown by extensive work the association of these organs with the calcium balance. The nature of the affection likewise suggests that this phase is worthy of careful investigation. Da Costa sums up Hawk's work by stating: "The metabolic changes of Paget's disease are of interest and probably of importance. They indicate a pronounced retention of calcium, magnesium and phosphorus, and a large elimination of sulphur. It may be that during the formation of new bone the osteoid tissue produces a highly sulphurized organic matrix which is gradually calcified by the deposition of calcium, magnesium, and phosphorus. In the course of calcification a certain amount of this sulphur must be replaced by the other elements. Hence, the retention of calcium, magnesium, and phosphorus, and the increased elimination of sulphur. This state of affairs is to a considerable extent the reverse of what we find in osteomalacia."

Knaggs seeks to correlate the disease with osteitis fibrosa and osteomalacia. In so doing he assumes a continuous toxic basis which acts in one with a peculiar susceptibility to bone disease. The picture which presents itself is influenced by the vitality of the patient. Osteitis deformans occurs when the vitality is great enough to resist the disease process until old age; when the reaction to the disease is only fair, osteitis fibrosa results; when no reaction occurs, osteomalacia. He assumes, of course, first a toxic basis, which is not proved, and further a peculiar susceptibility in certain individuals. The pathology he grants is different and the work of Hawk shows unlike metabolic variations.

The roentgenological description of the disease has been carefully set forth by Carman and Carrick who state: "The whole architecture of the bone is altered, the essential features being porosis and the formation of new bone with hyperostoses, one or the other process predominating in different parts. In later stages new bone tends to become sclerosed and takes on a dense white appearance with a much decreased permeability to the X-rays. The structure of the bone appears to be almost entirely removed and laid down afresh on a different plan and in a larger mould.

"The long bones lose their clear cut outline; they become curved, and the thickening appears to be greatest on the convex surfaces. In some places subperiosteal thickening is seen, while in others decalcification beneath the periosteum has progressed irregularly. The small cysts frequently mentioned in the literature were observed but once in our cases.

"The spine and pelvis when affected take on a dense white appearance, or the picture may be that of porosity with fine and coarse trabeculation, or there may be a combination of the two. The bodies of the lumbar vertebræ are flattened and widened compared with the normal. The joints are not involved; the process extends throughout the epiphyses; but there is no noticeable irregularity of the joint surfaces. There is no approximation of the articular surfaces that is suggestive of atrophy of the cartilages."

The same authors state that a preliminary report of bone metastases was made in 4 of their 15 cases. This occurs particularly when attention is directed first to the pelvis or spine. Not until the long bones and skull are rayed is the true diagnosis made. In 1 of the 4 cases, a diagnosis of osteitis deformans was made only after repeated examinations at intervals of a year; however, the consultant had leaned toward this affection rather than bone metastases. The changes in the skull, increased thickness of the outer and inner table, irregularity and porosity are most significant in a suspected case.

PATHOLOGY

The process of bone destruction as well as new bone formation is seen microscopically. Coarse trabeculæ of bone form the greater part of the picture. These trabeculæ have no plan and run irregularly interspersed by osteoid tissue. Calcification varies in density, in only a few places being dense. This probably accounts for the occasional hardness noted upon removing sections, which for the most part cut with surprising ease.

Many giant cells are observed. Figures 1 and 2 show them to be more abundant in certain areas. An eaten-out appearance of the adjacent bone obtains, the osteoclasts giving the suggestion of occupying a niche.

The marrow spaces are filled with oteoid tissue, consisting for the great part of a vascular fibrous tissue. Osteoblasts likewise are numerous in some instances lining by a single layer the marrow space or comprising the whole of the marrow cavity. Some round cell infiltration occurs, with diffuse or grouped arrangement of cells.

In bone so disorganized naturally the haversian systems are distorted.

The signs and symptoms of the disease are local and general. Pain is a common complaint and this varies in severity as it varies by its absence in some cases. Paget wrote that pain was "widely various in severity and variously described." It may be present for many months or some years before the patient seeks relief or other signs are manifest. Deformity which includes thickening, bowing, shortening of the long bones and spine occurs. The thickening may be great, the anterior tibial surface in our case increasing in width by one-third. The bowing is characteristically outward and forward in the femora and tibiæ. The shortening is not actual but due to the bowing. The skull becomes larger and the vault tends to flatten adding to the decrease in stature caused by bowing of the spine and long bones of the lower extremities and broadening of the pelvis.

Skin changes likewise vary. Among those seen are discoloration, such as that reported by Knaggs, pigmentation, glossy, smooth skin, and local hyperæmia. Bowlby reports necrosis occurring in a case. The skin changes are seen where the bone is close to the surface, as over the anterior tibial surface. Some of these changes at least might be explained on the

basis of vascular changes and undue pressure which is quite apparent.

Weakness was the most striking symptom of which our patient complained. She did not correlate her tibial deformity with this weakness which had become so extreme. She stated the effort to raise a fork was too much and added, "this was not sham because there was no need for it." Lewin reports weakness as a complaint in 1 of his cases and Carman and Carrick mention it in 2 of their patients.

Dizziness, deafness, and choroidal changes have al been found in connection with the disease.

Kidney function was impaired in Scully's case but nothing conclusive as to an interrelation was found. Pinney reports eosinophilia and basophilia in 5 cases. Many have reported normal blood findings however.

As for the clinical course of the disease it can be said it is a chronic one. Some are so little inconvenienced that only after years do they seek a physician for relief. Spontaneous fracture has brought several cases to the attention of a physician for the first time. Cone and Bowlby report the passing of 10 years in which one bone only has been involved; Lewin observed the bowing of legs in his patient for 12 years; 1 of Leri's patients had involvement of the tibia at the age of 52, radius at 63 and the other tibia at 80.

The skin changes follow the disease in the bone. Peruet describes thickening of the skin which began as a blush, in one who had bowing of the legs and spine for 16 years. He found the skin condition to be morpheoscleroderma. Knaggs attributes these changes to "impaired nutrition due to the retarding influence of muscular atrophy and diminished activity upon venous return."

Thus in such a chronic affection we find it compatible with life. Weakness or deformity may inconvenience one to a greater or less degree and fracture incapacitate, but even these tend to heal in the diseased bone. Furthermore, the disease may not be progressive and apparently becomes arrested in some for a time at least, when the patient has little or no discomfort.

Until our knowledge of the cause of osteitis deformans is added to, its treatment may continue to remain unsatisfactory. As the metabolism is being more closely studied, particularly the calcium metabolism, the parathyroid function in the disease, if any, may come to light. Bassler has just shown marked improvement in the well being of his patient on administration of parathyroid extract after the failure of many other forms of treatment.

Thyroid extract and multiple gland extracts have been of no proven value. Spontaneous fractures have responded well in bone showing such marked changes.

Fig. 3. The plate shows the right and left tibia, though unfortunately from different positions. The coarseness, bowing, and thickening are evident.

Mrs. J., aged 63, came to the dispensary March 2, 1926, complaining of an aching pain in the right leg and hip and extreme weakness.

Three months before she had bumped her leg on a car seat. The lower leg and area over the right buttock showed slight swelling. She remained in bed for a few days and returned to her work of sewing. The incident was forgotten until a month and a half later when she noted a weakness which was becoming greater. The weakness became so extreme that the lifting of a fork was exertion, she stated, in one who had always enjoyed good health.

It was a member of the family who at this time jested she was becoming bow-legged which first attracted her attention to the deformity of the tibia. At the time of admission this had progressed considerably. In the following weeks prior to her entry into the hospital, March 11, 1926, an aching pain in the hip and right leg had been present. Swelling below the knee appeared and this to the feel she

characterized as "spongy or cheesy" and also noted that the skin over the tibia had become discolored.

A roaring when suddenly turning the head had been noted. No changes in vision had occurred. The head had not increased in size. The patient limps, not being able to touch the heel to the ground on walking. Clinical: The patient was a well nourished individual. The heart and lungs showed no evidence of disease. The breasts and thyroid were negative.

The right tibia was bowed outward and forward. It was noticeably larger than the left. The skin over the anterior tibial surface had a yellow tinge with areas of blue gray discoloration. The skin to the touch was warmer than that of the left and was tense. The right leg showed one inch of shortening. The width of the anterior tibial surface was 6.5 centimeters compared with 4.5 centimeters of its fellow.

The X-ray showed marked bowing of the right tibia with increase (Fig. 3) of thickness and coarse trabeculation characteristic of Paget's disease. The left tibia shows no changes. Films made of the head showed some thickening of skull but no characteristic bone changes of osteitis deformans. The pelvis showed no definite bone changes. There was an irregular calcified area which probably represented a calcareous gland. No bone change could be seen in the femur.

The urine was negative; the blood count was normal.

Non-protein nitrogen 40 milligrams per 100 cubic centimeter of blood. Basal metabolic rate was plus 12, Wassermann blood test and Kahn test for lues were negative. The ophthalmologist reported the pupils, fields, and tactile tension as normal. With dilated pupils no changes were observed in the disks, vessels, or fundi.

On March 17, 1926, a section of the tibia was removed for study (Dr. Van Hazel). An incision of the skin over the anterior tibial surface was made and the skin flaps dissected back and elevated. The periosteum thus exposed was seen to be thickened and nodular. The vascularity was increased greatly. By use of the bone saw a section about 10 to 12 centimeters by 1½ centimeters was removed. The cortex was markedly thickened and cut readily at times due to the softness of the bony structure, being spongelike in character while at other times a resistance was met greater than that of normal bone, presenting an almost ivory-like hardness.

Grossly the section removed showed essentially a coarseness and was more brittle than normal bone. The wound was closed without drainage. Healing took place readily, the sutures being removed on the eighth day, and with exception of one stitch puncture from which some blood escaped, wound healing was complete.

Pathological report. The histological study of the removed specimen was made by Dr. Jaffe who reported: "Coarse and irregular trabeculæ of bone form a very dense network which is interspaced with fibrillar connective tissue. The trabeculæ consist of atypical bone. The lamellæ run in various directions and there is no distinct orientation of them. The bone itself is divided into irregular areas by indented lines of more pronounced calcification while the bulk of the bone shows only scanty deposits of calcium salts. The peripheral parts of the trabeculæ have a homogenous appearance and stain purple with eosin. The bone is quite cellular, the cells being located in wide and irregular cavities. In some places the trabeculæ are thin and more diffusely calcified. But also here the wide empty space about the bone cells is striking. There are a few small fragments of bone without structure and cells.

"The marrow consists of fibrillar connective tissue in which there are circumscribed areas of round cell infiltration. To the bone are attached numerous polyhedral cells with round nuclei. They usually form regular rows. There are very many giant cells which often are located in a groove of the bone."

Careful studies of metabolism were made in this case and numerous striking deviations from the normal were noted. In many of these deviations I shall attempt to show suggestions of a profound disturbance of the parathyroid secretion.

When the patient entered the hospital, the blood calcium was abnormally high, 13.05, in spite of the fact that the patient was evidently retaining much calcium. For a period of 10 days she was put on a milk diet which, of course, is rather rich in calcium and an analysis of all ingested material, both milk and water, was made daily. All the excreta during this period were saved and at the end of the period it was evident from Table I that the patient had retained 8.549 grams of calcium.

TABLE I.—BLOOD CALCIUM

Total calcium ingested	Grams	Total calcium excreted	Grams
Milk	12.180	Fæces	2.497
Water	.277	Urine	1.407
Total	12.453		3.904

In view of the high calcium content at the beginning of the series it was quite surprising to note this retention, and furthermore a blood calcium estimation made after this period of rest showed that there had been a fall in the blood calcium. The interpretation of these phenomena present extreme difficulties.

It is evident that although there was a retention of calcium in the sum total, a greater

amount than normal was vitalized. The urinary calcium, as has been previously shown by Hawk was higher than normal. Thus, although more was excreted, this was far overbalanced by the fact that an unusual amount was absorbed. The explanation suggests itself that the bone is unable to retain calcium and it therefore passes into the blood and is excreted. This point will be discussed later in relation to the pathological picture.

The lead having been gotten that changes in the permeability of the tissues might be present, this was tested out by the blister method, previously described by Peterson and Milles. A cantharides plaster was applied and the time required for blister is noted, and when the blister did appear the protein content of the blister fluid was tested by refractometer. In this the blistering time was more rapid than in most cases which we noted in several hundred estimations, and the protein content was also nearly the highest of any estimation of which we have yet made, giving evidence of most extreme permeability of the tissues. The protein content of the blister produced early in the course of the patient's stay in the hospital was 88 per cent of that of the blood serum. Later on after prolonged rest in bed when considerable improvement in the bodily strength had taken place this ratio dropped to 71 per cent.

In relation to permeability we also tested the absorption of glucose. On a fasting stomach a meal of 100 grams glucose and lemonade was given and the blood sugar estimations made hourly thereafter.

TABLE II.—TEST MADE TO DETERMINE THE ABSORPTION OF GLUCOSE ON MARCH 18, 1926

Time	Blood sugar
9:30	81.3
9:40	100.0 gm. glucose in lemonade
9:45	103.0
10:00	159.8
10:15	192.3
10:30	172.4
11:00	99.5

Urine negative for sugar.

TABLE III.—MARCH 26, 1926

Time	Blood sugar
8:00	88.0
8:05	150.0 gm. glucose in lemonade
9:00	236.0
10:00	110.0

Urine negative for sugar.

The unusual rapid rise, as compared to the normal, is clear and also the rapid fall in blood sugar. In 1 case only 100 grams were given and the blood sugar rose to 192, almost the threshold, and within the space of an hour and a half has fallen practically to normal. In Table III it is very striking that although the blood sugar was caught for the moment at 236 milligrams, far over the threshold it stayed at this level for such a short time that there was no overflow into the urine. The sudden rise is evidently connected with an abnormal permeability of the gastric mucosa and again the sudden fall suggests that its fixation in the liver or conversion into glycogen also takes place abnormally rapidly, and is another evidence of increased permeability.

The action of adrenalin injections was also tested out and they also appeared to be abnormal as shown in Table IV.

TABLE IV.—RESULTS OF ADRENALIN INJECTIONS

Time	Pulse	Blood pressure	Blood sugar
9:40	92	160-04	113
9:45	93	162-94	114.3
9:50	1 c. cm. 1–1000 adrenalin		
9:55	94	160-74	
10:00	105	142-76	
10:05	102	134-76	93.4
10:10	108	158-84	
10:15	99	154-84	
10:25	93	154-82	118.3
10:35	99	156-88	
10:40	102	158-86	
10:50	105	154-84	
10:55	105	152-82	
11:00	108	152-84	
11:05	110	154-82	114.3

The elevation of the pulse continues for an abnormally long time. The blood pressure instead of being elevated falls and the blood sugar does the same, both returning to normal at about the end of an hour. In view of what we know of the autonomic and sympathetic nerve balance, the possibility again suggests itself that with the picture of increased permeability the balance lies far on the parasympathetic side. The leucocytes ran consistently below normal at a great many observations, averaging under six thousand, which also fits into this picture. The basal metabolic rate was 12 plus and the calcium potassium ratio was 2.46 at the end of the period of observation. It was further noted on repeated experiments that the administra-

tion of adrenalin hypodermically caused a fall in the blood calcium (Table V).

TABLE V.—RESULTS OF HYPODERMIC INJECTIONS OF ADRENALIN

2:00 p.m.	Blood calcium 8.65
2:05	3 c. cm. of adrenalin hypodermically
3:00	Blood calcium 8.32

It is probable from the above statement that in this case there is a polyglandular disturbance of internal secretion, which in certain respects bears a striking resemblance to that of parathyroid disturbance. One of the most striking phenomena in this clinical picture was the extreme lassitude and weakness of the patient, the exact opposite of what occurs in parathyroid tetany. The same is true of the phenomena of increased permeability, the elevation of blood calcium, the calcium potassium ratio, the lassitude and weakness, as compared with the removal of the parathyroid. It is well known that a large number of German observers have consistently discovered post mortem parathyroid adenomata in Paget's disease. This finding, as can be shown from the following reference, is far too constant to be attributed to chance (Maresch). The only other suggestion of this relation which has come to our notice has been the note by Anthony Bassler in a recent contribution.

PATHOLOGY

A study of the pathological picture of the bone excised in this case more or less confirms that previously reported. However, in the case here reported the material was taken from the early stages of the condition. Paget's disease runs a very long and slow course in the later stages. Considerable repair takes place, the bones regain somewhat their normal strength and an examination of the biopsy specimen here cannot but suggest the picture of a regeneration. There is an absorption of calcium. In most areas all the elements of bone are present, but calcification has failed to take place. In addition to this there is an attempt on the part of the body to lay down new bone to compensate for the weakness from decalcification. This new bone which is laid down in large amounts is fairly normal in structure but is subject to the same defects as the old one. That is, the calcification is imperfect. In certain areas in both the new and old bone, calcification has taken place but when the entire field is studied as a whole the failure either of the deposition or retention of calcium is evident.

CONCLUSION

Therefore, the authors would suggest that the pathological picture can be explained on the following basis:—due to some disorder in metabolism, probably a hypersecretion of the parathyroid gland, there is an increase in the permeability of the tissues which entails an inability of the osseous structures to retain the calcium. Calcium can pass freely from a bone to the blood, vice versa, and in consequence very much of it is lost in the urine. These cases all show a positive calcium balance. The pathological picture in the bone is an attempt of the normal bone forming tissue to strengthen the bone, and the hypertrophic bone similarly fails to undergo proper calcification. For that reason growth continues, producing the syndrome of large, soft, decalcified bones.

NOTE.—Since the preparation of this paper, two additional reports on this subject have come to the attention of the authors. Parriera and Castro Freire (Compt. rend. soc. de biol., 1589, xcv, 1926) have identified changes in the parathyroids in osteitis fibrosa which they consider to be pathognomonic of hyperfunction. Mandl (Zentralbl. f. Chir., 1927, liii, 257) has removed parathyroid tumors in a case of Paget's disease and brought about improvement.

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MATERNAL OBSTETRICAL SCIATIC PARALYSIS

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A REVIEW of the literature shows that obstetrical sciatic paralysis has received recognition from an increasing number of sources in the past two decades. All told only a small number of cases of this affection have been reported. Because its manifestations are attracting great attention and because I desire to direct our thoughts again to the etiology and treatment I am prompted to record in detail 2 additional cases, each covering a period of many months. Thus far the condition has been impossible to prevent and difficult to control efficiently.

ETIOLOGY

From a study of the reported cases I am inclined to believe that we are dealing with a pressure paralysis of the sciatic nerves. In all but 3 cases there is undoubted proof of increased intrapelvic pressure due to one or more of the following factors: (1) a disproportion between the size of the pelvis and the fetal head; (2) a prolonged or difficult labor; and (3) instrumentation. The three possible exceptions are described by two observers. Patel[1] reports an undoubted case of obstetrical peroneal paralysis in a woman 6 months pregnant. This need not really be considered an exception, as there may have been in this woman's case, even at so early a stage, an abnormally large amount of intra-uterine fluid, with resultant unusual intra-abdominal pressure.

Howell[2] has described 2 cases of sciatic paralysis in women who had apparently normal, non-instrumental confinements. In all of the other cases of sciatic paralysis, however, we have two and often all of the above factors combined operating to cause paralysis. It is difficult to understand why it is that we so often see drop foot, which is evidence that there is a more severe involvement of the external peroneal nerve than of the other branches of the sciatic. Several authors have suggested that the explanation for this occurrence lies in the fact that those fibers of the lumbosacral cord destined to form the external peroneal nerve lie posteriorly and in direct contact with the bony wall of the pelvis, and hence are damaged the most.

Thomas, in the *Johns Hopkins Hospital Bulletin* in 1900, explained the condition as follows: "The upper roots of the sacral plexus do not lie on the pyriformis muscle, but against the bony walls of the pelvis, and are thus exposed to pressure during certain difficult labors. The dorsal off-sets of these roots lie against the bone and receive the chief injury. The external popliteal nerve is made up of these dorsal off-sets and therefore paralysis is chiefly located in the distribution of this nerve." Some observers believe that the paralysis is due to direct pressure of the fetal head. This may be true at times, but such pressure cannot be the real cause in most of the cases, because the symptoms are so generally bilateral. It is unfortunate that we have so little information in regard to the exact position of the presenting head in relation to the nerve cords. Such information might shed considerable light on the effect of different vertex positions on intrapelvic nerves. I believe that as a result of one or more of the

[1] Patel, Lyon méd., 1905.
[2] Howell, C.M.H. St. Bartholomew's Hospital Reports, xliv, p. 43.

pathological factors outlined above, an abnormal increase in the intrapelvic pressure causes a bilateral sciatic pressure neuritis and paralysis. The fact that the pressure is not of the same intensity on all the nerve bundles accounts for the peculiar and irregular distribution of the motor and sensory symptoms.

SYMPTOMS

There is always a bilateral lesion, although the symptoms are more pronounced on one side. The lesion is at or near the promontory, consequently the lower lumbar and upper sacral nerves are involved, and through them, the lumbosacral cord and the whole sciatic nerve. Thus there are motor and sensory disturbances. The pain is often very distressing and always annoying and exhausting. It may last for many months, but usually abates after several weeks. It tends to disappear long before there is improvement in the paralysis. Numbness and tingling, frequently present, are the earliest symptoms, but diminish soon after the onset. Of the affected muscles the anterior leg group is usually completely paralyzed or nearly so, the result being drop foot, which constitutes a conspicuous defect. The other muscles of the leg and those of the thigh and even the buttock have variable degrees of weakness, but are paralyzed only exceptionally and then only temporarily.

COURSE

The prognosis is extremely uncertain. In some instances there is rapid improvement to a practical cure, as in my second case. In others there is a permanent drop foot with disability. There is at present no means of estimating the severity of the lesion, nor any way of knowing which is the best therapeutic method to hasten the cure or limit the ultimate defect. The treatment is of necessity entirely symptomatic, consisting of measures to relieve pain, to maintain muscle tone, and to hold the foot at a right angle to the leg by some simple appliance until recovery or improvement ensues. It is encouraging to remember that my first patient, who appeared to have a permanent drop foot at the end of nearly 2 years, has since recovered sufficient power in the extensor longus digitorum and peroneus tertius to be able to walk without a limp and without a brace.

The most effective treatment must evidently be prophylactic and lies in the hands of the obstetrician. He must bear in mind the possibility of a pressure neuritis and paralysis of the sciatic nerve resulting from abnormal intrapelvic pressure. It is his duty to avoid severe instrumentation and particularly prolonged labors. He must in addition anticipate and prevent the possible ill effects from abnormal pressure that occurs in cases of disproportion between the pelvis and fetal head. Most obstetricians deny any personal experience with postpartum sciatic paralysis, or Erb's palsy in the newborn, feeling that such a condition is a reflection on their skill. It might be well to assume that it is a reflection on their ability, and thus to stimulate greater care on the part of those devoting themselves to obstetrical practice.

CASE REPORTS

CASE 1. Pearl R., 28 years old, a primipara, had a difficult labor due to an abnormally large fetal head. She went into labor on June 12, 1924. The head of the fetus became engaged in the true pelvis, but it was too large to pass through the outlet. The maternal pelvis was of normal size and conformation. This was confirmed by me at a later date by stereoscopic X-ray examination. After a tedious and exhausting labor, during which high forceps and axis traction were employed without success, a craniotomy was performed and a fetus weighing about 14 pounds was delivered.

When the patient recovered from the anæsthesia she complained of severe pain in both legs and feet. On the next day the pain was intense and it is said that she could not move either lower limb. Within a day she recovered motor power in her thighs and knees, but had bilateral drop foot. The paralysis of the left foot disappeared within a short time, but the right foot drop persisted. A month later an ankle brace with a stop joint was applied. In November, 1924, 5 months after the delivery, she still had pain in both legs and a right drop foot, walking with the aid of a brace. There was an atrophy of 1 inch in the right leg, complete paralysis of the anterior leg muscles, the peronei and the tibialis posticus, and weakness of the flexor longus hallucis.

A neurological examination in November, 1924, by Dr. E. D. Friedman, of New York, revealed a lesion limited to the legs. His report states: "There is distinct foot and toe drop on the right side with inability to effect dorsiflexion of the right foot.

The ankle jerks are both absent. There is some wasting of the right leg. All forms of sensory changes are present in the distribution of the right peroneal nerve. Milder sensory changes are present along the outer margin of the left foot.

"Electrical tests reveal diminished galvanic and faradic responses in the peroneal and anterior tibia group of muscles on the right. There is also some impairment of faradic response in the posterior tibial groups on both sides.

"I do not believe the findings at present can be attributed to any cord injury. It seems to me that they are best explained by a lesion of the lumbosacral cord in the pelvis. This would mean a bilateral sciatic nerve injury with more marked involvement on the right."

One year later, that is in October, 1925, this patient, having worn the brace continuously and received physiotherapy regularly, had improved decidedly. She had no pain in either leg and she had learned to walk almost without a limp. There was still some numbness in the right leg and complete paralysis of the anterior leg group and peronei muscles. The tibialis posticus and the flexor longus hallucis were no longer involved. Electrical tests at this time by Dr. Hanson of the Hospital for Ruptured and Crippled showed a complete degeneration reaction of the right external peroneal nerve. Physiotherapy was continued to maintain the muscle tone while we were waiting for a possible recovery from the nerve lesion.

In May, 1926, nearly 2 years after childbirth, there was still complete paralysis of the muscles supplied by the right external peroneal nerve, with complete foot drop. The condition was considered permanent. To correct the foot drop and improve walking, the bone block operation on the back of the ankle devised by Dr. Campbell, of Tennessee, was recommended. The patient refused to have this done.

This patient was recalled for examination on July 2, 1926. I was very much surprised to see her walk without any limp. She stated that she had practically forgotten about her foot trouble because she had no pain and no limp and could walk as much as she pleased. An examination showed that she had recovered some power in the extensor longus digitorum and the peroneus tertius muscles, as a result of which dorsiflexion of 120 degrees was possible, just enough to eliminate the limp. She had also slight power in the peronei muscles. She has evidently improved in the last few months, which is more than 2 years after the onset of paralysis. There is still complete paralysis of the tibialis anticus and extensor proprius hallucis, but in view of the recent return of motor control further improvement may presumably be expected.

The outstanding features in this case are:

1. The patient had a normal and rather capacious pelvis.

2. The fetus was abnormally large, disproportion resulting.

3. A prolonged and difficult labor necessitated much instrumentation with considerable attendant trauma.

4. Sciatica and paralysis of both legs appeared immediately after delivery.

5. Gradual improvement was marked by early complete disappearance of the paralysis in the left leg and slowly diminishing paralysis in the right leg.

6. The sensory disturbances in both legs completely disappeared.

CASE 2. Mrs. R., 23 years old, a primipara, went into labor on June 22, 1925. As there was no progress at the end of 36 hours, high forceps were applied and a dead child weighing 8½ pounds was delivered. As soon as the patient became conscious she complained of coldness and numbness in the left lower limb which felt as if it were asleep. On the following day she felt somewhat easier, but on the third day she experienced great pain in the left buttock, leg, and foot. The pain was very severe at the time of my first examination, July 10, 1925, about 17 days after delivery. The pain was especially marked over the external aspect of the left leg and foot. She also had some discomfort in the right leg, but this was greatly overshadowed by the intense suffering on the left side. Lying down and sitting were very uncomfortable positions. She was least uncomfortable when squatting. This patient was seen by the physician who called me in consultation 4 days before I saw her. He found only partial dorsiflexion of the foot possible, and immediately applied a plaster of Paris ankle bandage to hold the foot at a right angle to the leg. Consequently I was unable to investigate the condition of the muscles about the ankle at this time. The patient states that she first became aware of the weakness and the drop foot on the third day postpartum.

I saw her again on September 23, 1925. The pain had greatly diminished and she felt better and was able to walk about fairly comfortably. Examination of the muscles of both lower extremities showed no paralysis on the right side, while on the left side the tibialis anticus was paralyzed and all of the thigh and leg muscles were weak. The left thigh was atrophied 1¼ inches, and the left calf ¾ inch. Vaginal examination showed a bilateral contracted pelvis, that is, a narrow elongated male-like pelvis. This was recently confirmed by a stereoscopic roentgen-ray examination. Consequently, though the fetal head was not abnormally large, there was, nevertheless, a marked disproportion between the size of the fetal head and the maternal pelvis.

On January 30, 1926, she presented a very marked improvement. She had no pain in either lower limb, but the numbness in the external aspect of the left leg continued. She walked without a limp. There was no paralysis of the muscles of the left lower limb, although there was some weakness about the

hip and knee and in the anterior leg group of muscles. Dorsal flexion was still limited to 100 degrees. The atrophy of the left thigh had become less pronounced, but the left calf was still ¾ inch smaller in circumference than the right. An electrical examination made at the Hospital for Ruptured and Crippled by Dr. Hanson showed an apparently complete regeneration of the left external peroneal nerve.

An examination on July 3, 1926, 13 months after the onset of symptoms, showed practically complete recovery. She had full control of the left lower limb, no pain in either leg, and walked as much as she pleased without a limp. The only evidences of the previous disturbance were atrophy of the left leg and thigh, a light dulling of sensation on the external aspect of the left leg and on the dorsum of the foot, and an absence of the left ankle jerk.

The salient features in this case are:

1. The patient was a primipara.
2. The labor was terminated by instrumentation and a great deal of trauma.
3. The disturbance arose from the fact that though the fetal head was normal, the pelvis was contracted and abnormally small.
4. The symptoms were bilateral, but were more marked on the left side.
5. The early symptoms indicated a pressure on the lumbosacral cord similar to the crutch paralysis in the upper extremity.
6. There has been practically complete recovery.

SUMMARY

Maternal obstetrical sciatic paralysis occurs, fortunately, only rarely. It usually follows a severe labor in which decided difference between the size and shape of the pelvis and that of the fetal head is encountered, and in which more or less extensive instrumentation has been employed. The paralysis is apparently due to an increase in the intrapelvic pressure causing trauma to the sciatic nerves. The symptoms usually appear immediately after the delivery, but are at times delayed several days. They are bilateral and include motor and sensory changes. Drop foot resulting from involvement of the external peroneal nerve is a conspicuous sign. It may disappear partially or completely, but at times, as far as our present information goes, may remain permanently. The treatment is entirely symptomatic, and the prognosis must be guarded, for we have no means of discerning the degree of trauma to the sciatic nerves, nor do we know any curative measure.

CLINICAL SURGERY

FROM THE GERMAN UNIVERSITY EYE CLINIC

OPERATIONS FOR TUMORS OF THE ORBIT[1]

By Professor Dr. A. ELSCHNIG, Prague, Czechoslovakia
Director of the German University Eye Clinic

DIAGNOSIS

THE choice of operation for disease processes in the orbit depends chiefly upon the kind and location of the disease, also upon exact diagnosis. In general, all the non-acute inflammatory processes cause a more or less slowly increasing change of position (exophthalmos) and displacement of the eyeball. By the manner and direction of the displacement it is possible to locate the disease process even though it cannot be palpated. The latter is made easy by the observation of all related signs and symptoms. Tumors in the muscle cone or in the region of the optic canal quickly lead to the appearance of higher grades of congestion in the optic nerve (choked disk); tumors in the optic nerve and in the optic canal lead to early high grade disturbance of vision or blindness. Because they grow slowly, benign tumors do not give the appearance of congestion in the lids or conjunctiva; they cause only collateral dilatation of vessels. Because of the anterior location of these tumors, especially those rich in blood vessels (hæmangiomata, sarcomata, and hæmangiomatodes), and of the chronic inflammatory tumors caused by syphilis and tuberculosis, the appearance of congestion, œdema, and hyperæmia of the conjunctiva and lids can be noted relatively early.

In the differential diagnosis of tumors of the orbit, we will first consider diseases of the accessory sinuses (mucocele or chronic empyema), such as bulging of the inner orbital wall caused by mucocele of the frontal sinuses, similar bulging in the ethmoid cells on the median orbital wall, and the much rarer bulging of the lower wall of the orbit due to empyema of the antrum of Highmore. It is necessary to establish the location and extent of the mucocele both by rhinological and roentgenological examination. Such examinations should never be omitted in the diagnosis of diseases of the orbit.

Frequently melanin or melanogen appears in the urine in advanced cases of melanotic tumors and especially when metastases to the liver are present.

In the differential diagnosis, chronic syphilitic periosteitis, leukæmic or pseudo-leukæmic tumors of the orbit or orbital contents (Hodgkin's disease) must be considered. Therefore, before every operation, a complete blood examination, including a blood count and a Wassermann test, and an examination of the entire body should always be made.

In children it is also necessary to consider an encephalocele, and in cases of rapid increase in exophthalmos, hæmorrhages (Barlow's disease) which very often simulate an acutely inflamed mucocele of the nasal sinuses. These hæmorrhages have the appearance of an orbital phlegmon or an acute orbital inflammation. Immediate operative interference is indicated in such cases.

Cysts of the orbit are very common, such as dermoid cysts, at or near the orbital wall, often imbedded in a niche of bone; honey cysts; and occasionally blood cysts.

In the last few years a great number of chronic inflammatory tumor-like processes have been recognized. These develop slowly on certain parts of the orbital tissues and seem to originate especially in the lachrymal gland. The etiology is obscure; but because the process may extend to the second orbit, it should be removed like a genuine tumor by operation, if the general and roentgenological treatment fails. In such cases one must also consider the presence of chronic sepsis; therefore it is necessary to take the temperature and make a bacteriological examination of the blood.

The borders of these inflammatory tumors are not sharply demarcated; and they must not be radically removed.

[1] Translated by S. J. Meyer of Chicago, voluntary assistant in the German University Eye Clinic, Prague, Czechoslovakia.

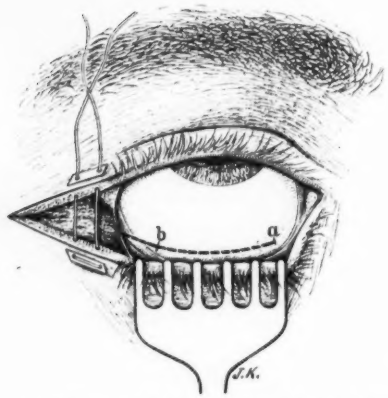


Fig. 1. Incision through the conjunctiva if the tumor is near the æquatorial region of the eyeball. The canthotomy wound is closed by a silverplate suture.

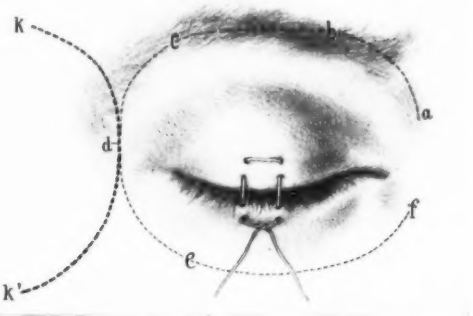


Fig. 2. Positions of the various skin incisions. *a b c d e f*, Orbital margin incision. *a b*, Orbital margin incision for a tumor situated superiorly and medially. *b c*, Orbital margin incision for a tumor situated superiorly. *c d*, Orbital margin incision for a tumor situated superiorly and laterally (lachrymal gland). *d e*, Orbital margin incision for a tumor situated laterally and inferiorly. *e f*, Orbital margin incision for a tumor situated inferiorly. *k d k*, Skin incision for a Kroenlein operation. The palpebral fissure is closed by means of a bridle suture. The eyebrows are naturally shaved. They are only shown in the illustrations more clearly to indicate the position of the incisions.

PREPARATION

General examination should be made for diseases of the nose and face such as acne or furunculosis, which might be the original source of the infection and should be treated beforehand. The mouth should be made aseptic. The eyelids and their surroundings should be shaved and painted with two applications of tincture of iodine.

I always wear the head lamp while operating, for only with such a light is the operator able to move freely and yet obtain a good view into the depth of the orbit.

ANÆSTHESIA

Local anæsthesia is indicated only in cases of small tumors, and those situated anteriorly, close under the lids or conjunctiva. A needle 4 centimeters long is inserted close to the lateral orbital border in the direction of the optic canal, and is aspirated back. Should blood come, the syringe is withdrawn, as injection into a blood vessel must absolutely be avoided. Two cubic centimeters of a 2 per cent novocain solution with the addition of a few drops of adrenalin is injected toward the apex of the orbit (ciliary ganglion). A similar injection is made by the insertion of the needle over the medial palpebral ligament. In withdrawing the point of the needle, a little novocain is also injected along the medial orbital wall. If after 5 minutes, the anæsthesia is not sufficient, a similar injection should be made along the roof of the orbit. I prefer general narcosis with ether with a preparatory injection of 4 centigrams of pantopon or 2 centigrams of morphine, because local injection swells the orbital contents and increases the difficulties of the operation. When I use general narcosis, I induce anæsthesia of the surrounding tissues of the orbit by novocain injection in the region of the incision or of the supra-orbital nerve.

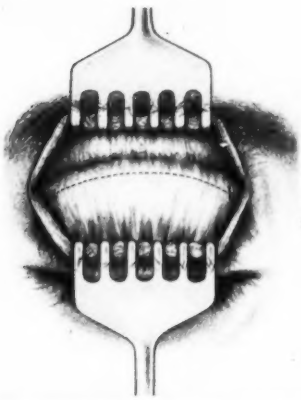
The orbital tumors can be reached in three different ways: (1) through the conjunctival sac (in very rare cases); (2) by means of an incision through the skin; or (3) by exposure of the orbital structures through temporal resection of the lateral orbital wall, after the method of Kroenlein.

I. OPERATION THROUGH THE CONJUNCTIVAL SAC

Approach through the conjunctival sac is to be considered only when the tumor is in proximity to the eyeball in the anterior parts of the orbit without being fixed to the eyeball, and is small and does not go deep into the orbit. Therefore it is applicable only in rare cases.

When the tumor is located deep in the orbit, the operative procedure is as follows:

In the lengthening of the palpebral fissure, the outer lid commissure is cut through close to the orbital border with the scissors (canthotomy), while the lid is held fast with the forceps and the other connections of the lids (lateral palpebral ligament or relatively the tarso-orbital fascia) are cut through upward and downward, close to the orbital border, with the scissors. This is done so that the lids can be moved quite freely. Then



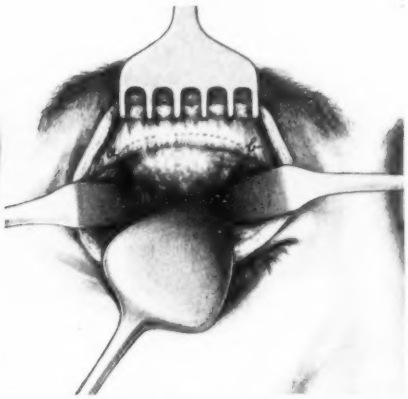


Fig. 3 (left). Freeing the upper orbital margin. *a b*, Incision through the fascia tarso-orbitalis in tumor of the upper orbit.

Fig. 4. Tumor of the roof of the orbit. *a b*, Incision through the periosteum, if the tumor is to be extirpated in connection with the periosteum or the bone.

a suture placed through the skin and the conjunctiva and loosely tied, stops the bleeding and serves at the same time as a bridle suture to control the lids. Then the lids are retracted with the bridle suture or with blunt hooks placed between the lid margins corresponding with the position of the tumor, and a sufficiently large incision is made through the conjunctiva on the fornix. (Fig. 1.)

After the insertion of sharp wound retractors in the conjunctival wound, and after hæmostasis has been effected by the use of adrenalin, tampons, or forceps, the operator dissects bluntly with the closed scissors onto the tumor, and grasps the tumor with hooked forceps and shells it bluntly out of the orbit. If there are many blood vessels on the surface of the tumor, they are clamped at a moderate distance from the tumor with artery clamps, and cut on the tumor side and tied. If the tumor cannot be easily shelled out, one carefully inserts the index finger (covered, of course, with a rubber glove) into the orbit and palpates for the location and size of the tumor. While the tumor is pulled forward with forceps, an artery clamp is inserted about ½ centimeter behind the posterior border of the tumor and the tumor is separated from its pedicle. If this exposes many blood vessels, they should be tied with silk. All the eye muscles with which one comes in contact (also the rectus inferior, obliquus inferior, and eventually one or both of the lateral recti) must be carefully preserved and drawn aside with blunt hooks. This is the procedure if the tumor is in the lower part of the orbit.

If the tumor is in any other situation, the incision through the conjunctiva corresponds to the position of the tumor. The degree of success naturally depends upon the nature of the tumor, especially whether it is sharply defined or not. Quickly growing malignant tumors are never shelled out in this manner with any kind of surety. One can consider this operation only for cases of benign connective-tissue tumors such as fibromata, lymphangiomata, and hæmangiomata; and thick walled cysts, such as dermoid cysts and honey cysts. However, in the case of hæmangiomata, radical extirpation is as a rule not possible, as here the bleeding is best controlled by cauterization with the Paquelin. A small drainage tube is placed in the wound and directed to the side between the lids. Throughout the operation, the cornea must be kept moist; it may be frequently covered with the intact upper lid and moistened with physiological salt solution. It is also recommended that during the operation the cornea be covered with coagulated blood.

After satisfactory hæmostasis has been effected, the conjunctival wound is closed with a continuous suture, and the canthoplastic wound is exactly approximated and sutured with silver plated wire (Fig. 1). The conjunctival sac is washed out with iodine (Pregl) solution. If the conjunctiva is not perfectly free of bacteria, the site of the tumor should be washed out before the wound is sutured. To determine the presence or absence of bacteria, a bacteriological examination is made before operation. A pressure bandage is applied over the closed lids and the other eye

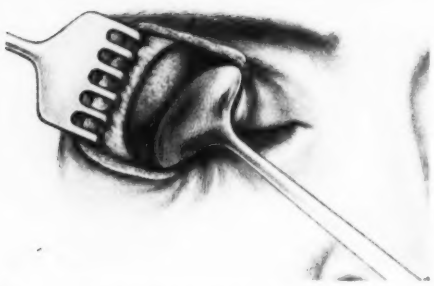


Fig. 5. Lachrymal gland tumor, exposed by orbital marginal incision (Fig. 2, *c d*).

should also be kept closed for 2 to 3 days. If there should be no irritation, the conjunctival sac is irrigated daily with iodine or mercury oxycyanide (1:5000) solution. After 5 to 6 days the sutures are removed and the bandage is left off.

A tumor below the levator in the upper half of the orbit cannot be reached by this method without destroying the levator. There one can reach the tumor by means of a dissection from the lateral parts of the orbit, best by the third method.

II. OPERATION BY MEANS OF AN INCISION THROUGH THE SKIN

This procedure is suitable only for tumors in the neighborhood of the entrance to the orbit, if they lie outside the muscle cone; and it is suitable for tumors in the upper circumference of the orbit, only if the tumor lies between the levator and the *upper* orbital border; therefore this operation is applicable in cases of tumors arising in the periosteum or bone. It is especialy applicable in the cases of the ivory exostoses of the orbit produced by diseases of the nasal sinuses, or of tumors from the accessory nasal sinuses protruding into the orbit.

The preparation of the patient is similar to that used for any surgical operation. The upper eyebrow, forehead, temples, and the bordering skin of the cheek are shaved. When the operation is to be extensive, and temporal resection of the lateral wall after Kroenlein has to be carried out, the anterior third of the hair of the head on the side operated upon should be shaved. The site of operation is painted with tincture of iodine, and anæsthesia induced. The lid opening is closed temporarily with a mattress suture through the upper and lower lid with the skin folded over for a distance of 1½ centimeters (Fig. 2).

If the tumor lies in the upper circumference of the orbit, the incision should be made in the upper eyebrow; in every case the incision should be made preferably a little outside of the bony border of the orbit, that is, not in the lid region; or if medial, not in the region of the lachrymal sac. In Figure 2 the various incisions are seen to be circular incisions, and each incision is designated by letters.

The incision is made down to the bone, without cutting through the periosteum. The bleeding is controlled, then the tarso-orbital fascia is immediately incised after the wound margins are retracted with broad pointed retractors (Fig. 3, *a*, *b*). If the operator is not experienced in orbital operations or if the case is complicated, the free edges of the tarso-orbital fascia are secured with a bridle suture of No. 1 silk and then laid to the side. Then sharp pointed retractors are inserted, and by gentle dissection with scissors the anterior borders of the tumor are exposed. The procedure now differs according to whether the tumor originates in the orbital wall or in the orbital structure itself. Tumors of the orbital wall usually originate in the accessory nasal sinuses.

Tumors of the bony wall of the orbit. After the introduction of the sharp retractors, the tumor is exposed and freed posteriorly by blunt dissection with an elevator or closed scissors. A comparatively large orbital spatula (Fig. 4) is then inserted, and the borders of the tumor defined posteriorly and laterally. It is also recommended that at this time the operator palpate the orbital structures with the finger after having changed to fresh rubber gloves. If the region of the trochlea must be exposed, it should be loosened with a piece of periosteum and neighboring bone, so that it can be placed aside in the soft orbital tissue.

At a sufficient distance from the outer anterior border of the tumor, the periosteum is incised (Fig. 4) and loosened with a rasp on all sides for a distance of about 1 centimeter. In the region of Figure 2, *a*, *b*, one also has to cut through the supra-orbital nerve, if the tumor is situated in this position. The periosteum is then separated anteriorly from the healthy bone with a straight chisel and hammer, so that the anterior borders of the tumor are exposed. The periosteum of the orbit is thus left attached to the tumor. Only in rare cases of ivory exostoses, which are absolutely benign, can that part of the periosteum of the orbit which touches the tumor be loosened and preserved with the soft parts of the orbit. By gentle chisel blows the bone is separated on both sides, and finally at the posterior border of

the tumor, a broad orbital spatula is inserted, with, if necessary, a smaller one on each side. In these cases, the accessory sinuses are usually also diseased, and it is best to expose them by punching or chiseling away the anterior wall, and to curette the mucous membrane with a sharp curette. In these cases, it is advisable to make a broad opening into the nasal cavity. The wound is then flushed with iodine (Pregl) solution.

When an accessory sinus is opened, it is packed with iodoform gauze, and the tampon is led out either through a corner of the wound or through the nose. In the latter case the skin can be completely sutured, and if no communication with the nose exists, a drainage tube can be inserted near the strip of iodoform gauze.

Then the orbital fascia is closed with two or three fine silk sutures, and the skin wound is closed with deep and superficial sutures. In the case of a small tumor, if no accessory sinuses are opened, the wound can be completely closed without tampon or drain. If one is not certain of asepsis, or if bleeding is not fully controlled, it is better after flushing the wound with the iodine solution, to insert a drain from a corner of the wound down into the depth of the orbit. The drain is removed after 48 hours if no pus has formed. Slight oozing of blood is controlled by a pressure bandage over the closed eye. If evidences of infection appear, such as swelling of the orbital tissue, œdema of the bulbar conjunctiva, exophthalmos, and rise in temperature, the wound should be opened to its full extent, washed thoroughly with iodine (Pregl) solution, and kept open with xeroform gauze or sterile gauze impregnated with the iodine solution.

If the tumor extends posteriorly in the region of the orbital roof, the dura mater is often exposed. If the new-growth encroaches upon the dura or frontal lobe, a resection of the latter is done. In this case, after the application of the iodine solution, broad strips of gauze should be laid on the defect in the brain and dura, and led out in a broad strip while the skin incision is closed only partially on both sides. If the accessory sinuses have also been opened, they are packed with iodoform gauze, which is led out separately as far as possible from the gauze covering the brain.

In tumors on the medial orbital wall, the incision lies as much as possible above the inner lid margin (Fig. 2, *a*, *b*). The lachrymal sac is loosened out of its fossa by bringing it forward, if possible, without injury to the lachrymal duct or sac. Then the periosteum is separated over a wide area posteriorly. As a rule, in malignant

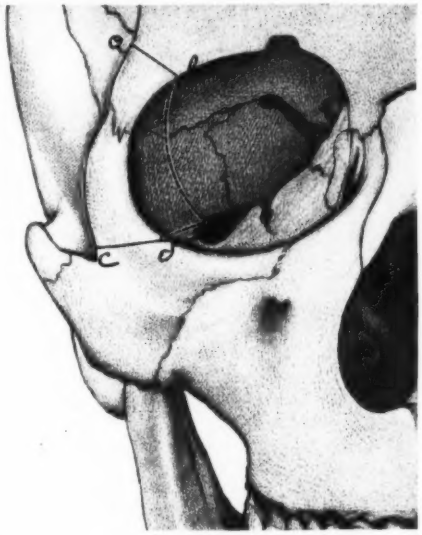


Fig. 6. *a b*, Upper; *c d*, lower periosteal incision; *b d*, marginal periosteal incision. Dotted line shows incision through the lateral wall of the orbit.

tumors of the medial orbital wall, the lachrymal sac is also diseased and should be removed with the tumor. In tumors of the lower inner part of the orbital wall, one must avoid the inferior oblique muscle (Fig. 2).

Postoperative treatment. The wound is covered with vaseline-impregnated gauze and the bridle suture of the lids is left in place if there is much exophthalmos; if no exophthalmos is present, the sutures are removed, the lids are well padded, and a pressure bandage applied. If drains and tampons have been used, they are removed after 2 days, and renewed if there is oozing or pus in the wound.

Unless it causes irritation, gauze packed on the brain should be left in place 6 to 8 days.

When the tumors are situated in the orbital tissues, but outside the muscle cone, the skin is incised, the fascia tarso-orbitalis divided, and the tumor freely exposed by careful blunt dissection. In the case of possibly malignant tumors, one attempts to keep as large a layer of tissue as possible on the tumor. When the tumor is hard, it is usually advisable to make an exploratory puncture, as very often dermoid cysts or honey cysts are thickly encapsulated and have the appearance of tumors. In the presence of many blood vessels, the procedure is the same as that formerly described.

It is usually possible to expose the tumor by inserting deep in the direction of the eyeball a broad orbital spatula, and if necessary small orbital spatulas laterally (Figs. 4 and 5). If it is found at the operation that the tumor extends farther posteriorly into the orbit than the former examination revealed, it is necessary to continue with a Kroenlein temporal resection of the orbit. Also when the tumor lies medial to the eyeball, the orbital spatula can be used to push the eyeball and soft parts far enough away so that the approach to the operative field is broad and entirely free.

In many cases I have dissected free only the periosteum at the orbital border, made an incision along the brow and through the periosteum, pushed it back anteriorly and posteriorly with a rasp, and removed the bony border with Luer bone cutting forceps. This method is especially applicable when the tumor is in the deeper parts of the orbit. Often by this method one can make a sufficiently large approach into the deeper part, especially when the orbital ridge is very prominent. This approach is possible only along the upper and outer wall of the orbit. Care must be exercised not to open the frontal sinuses. Cosmetically, the small defect in the bone does not have to be considered.

If the tumor is relatively large and has resulted in marked limitation of motion of the eyeball and œdema of the optic nerve (choked disk), or if the tumor is apparently possibly malignant, the patient's permission should be secured to do an exenteration of the orbit. If it is possible only to expose the tumor in the anterior parts by a small incision on the orbital border, an exploratory excision is made for histological study. Such an exploratory excision is usually advisable, and the diagnosis should be made immediately, if possible, from the frozen sections. If the tumor is malignant, much of the surrounding tissue must be extirpated and the eye muscles sacrificed. If the tumor is very large, and encroaches upon or includes the eye muscles or eyeball, it is advisable to sacrifice the eyeball and remove the anterior part of the orbital structures or the whole orbit. Should the tumor be attached to the periosteum, it is absolutely necessary to remove it by cutting through the healthy periosteum and removing the tumor with the periosteum. Before the tumor is removed an orbital spatula is inserted about 1 centimeter from the tumor. Should the bones not be absolutely intact, or should it be a case of malignant tumor of the orbital tissue (sarcoma), the bordering bone is carefully removed with a curved chisel, injury to the neighboring accessory sinuses being avoided. The rest of the procedure has already been described.

III. TEMPORAL RESECTION OF THE OUTER BORDER OF THE ORBIT: THE KROENLEIN OPERATION

In all tumors of the soft orbital tissues which lie far posterior in the orbit or are retrobulbar, it is necessary first to expose the orbital contents by a temporal resection of the lateral wall of the orbit by the method of Kroenlein. I then proceed in the following manner:

After a skin incision is made (Fig. 2, *k k*), a periosteal incision is made at both the upper and lower ends of the lateral orbital wall (Fig. 6, *ab*, *cd*); the periosteum is dissected free for a short distance both upward and downward, with the periosteal elevator; then a third periosteal incision is made along the lateral wall of the orbit (Fig. 6, *bd*). Bluntly one loosens the periorbita from the whole lateral orbital wall until the inferior orbital fissure is reached. Then after hæmostasis is obtained, the orbital wall is cut through with the circular saw, first below, then at the upper border in a horizontal direction (Fig. 7), while the orbital contents are protected by an orbital spatula. The rotation of the circular saw is directed outward so that if it should slip it would not strike the orbital structures. The lateral wall of the orbit is cut through with the straight chisel and hammer from the inner side, in the form of a triangle the apex of which is at the inferior end, while the orbital spatula is inserted from the upper and lower saw-cuts into the inferior orbital fissure. Injury to the large vein lying in the inferior orbital fissure must be avoided. If such injury should occur, the bleeding can be stopped by the insertion of a small adrenalin sponge. Then the entire mobilized bone is pulled outward with a resection hook and is covered with sterile gauze.

The rest of the procedure depends entirely upon the position of the tumor. If the tumor is situated in the outer half of the orbit or in the muscle cone, it can be reached through the Kroenlein incision. If it should be more toward the medial half of the orbit, the Kroenlein skin incision is lengthened by an incision along the orbital margin either above or below, according to the location of the tumor. An incision should be made in the periorbita almost corresponding to the incision in the orbital border in the lateral half of the orbit. From the middle of the incision an incision is made vertically backward with the scissors or scalpel (Fig. 8), and both ends of the incision are caught with a bridle suture and pushed bluntly sideways. The procedure from

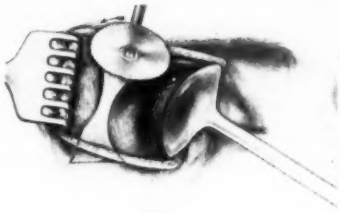


Fig. 7.

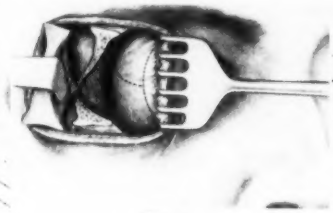


Fig. 8.

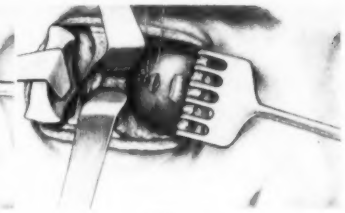


Fig. 9.

Fig. 7. Incision of the orbital margin with the circular saw. The dotted line indicates the position of the lower periosteal incision.

Fig. 8. Kroenlein operation with the lateral orbital margin tilted outward. The dotted lines indicate the position of the incisions in the periosteum of the orbit which are made to expose the orbital contents in the lateral half of the eyeball.

Fig. 9. The rectus lateralis is tied and incised to allow better access to the contents of the muscle cone.

this point depends upon the position of the tumor.

Tumors outside the muscle cone. If the tumor should be situated outside the muscle cone, the periorbital incision is drawn back both upward and downward with a blunt retractor; then the tumor is bluntly dissected free with closed scissors, and caught with rat-toothed forceps. If the tumor is malignant it is isolated directly around the tumor capsule or isolated some distance from the capsule, according to the probable degree of malignancy.

Bleeding blood vessels are ligated; and finally, if possible, when the tumor is not fixed posteriorly, it is removed by blunt dissection from the orbit. If bleeding should occur, it can be stopped by quick tamponade. In this way the tumors of the tear gland, which are of the most frequent occurrence, can be easily shelled out. When the tumor has been freely isolated anteriorly it is forcibly pulled forward, the posterior part of the tumor is palpated with the fingers, an artery clamp is inserted about 1 centimeter behind it, and the blood vessels in the stump are caught before they are cut through with the scissors. Ligation of the vessels is as a rule not necessary, but if it should be required, the silk sutures are carried into the depth of the orbit with two forceps. Usually the bleeding can be stopped after the artery clamps are removed, by brief tamponade. As a rule tumors of the lachrymal gland reach into the outer upper fornix border of the conjunctiva or are attached to it, so that they are excised with it, that is, the conjunctiva is "button holed." Such a "button hole" can be immediately closed with one or two fine silk sutures.

Tumors in the muscle cone. When the tumor is in the outer half of the muscle cone, the rectus externus is freed by blunt dissection. It is then grasped about 1½ centimeters from its tendon with a blunt muscle hook, and pushed aside, so that with the insertion of a second strabismus hook on the opposite side or a small orbital spatula, the tumor is freely exposed. If the tumor is not then approachable, that is, if it is situated in the deeper medial half of the muscle cone or in the optic nerve sheath, the rectus externus is made fast ½ centimeter posteriorly from its tendon insertion by a loop of thread, fastened, cut with the scissors between the insertion and the loop, and laid aside (Fig. 9). Free tumors in the muscle cone can then be bluntly shelled out. When sight remains in the eye, one must avoid any approach to the optic nerve in the lower and inner circumference with possible injury to the central artery and vein of the optic nerve which enter and leave this part of the nerve. In optic nerve sheath tumors, which are usually benign, the eyeball is grasped at the rectus externus tendon with rat-toothed forceps, and rolled inward. The optic nerve is separated close to its entrance to the optic canal with one stroke of the large curved scissors. Then the eye is rolled about and the nerve cut through close to the entrance of the optic nerve into the eyeball with scissors or knife. The bleeding is controlled by the insertion of an adrenalin tampon and forcible pressure on the orbital tissue for a few minutes.

One should never forget to remove the tampon before closing the wound!

Then the rectus externus is resutured to its tendon with 2 or 3 fine silk sutures, the orbital tissues and fat replaced into their former position over the rectus externus, if possible, and the periosteum of the orbit sutured into its correct position with 2 to 3 fine silk sutures. If the eyeball or conjunctiva has been exposed during the removal of the tumor, one should attempt to place between it and the periosteum of the orbit or the lateral wall as much orbital tissue or fat

tissue as is possible and if necessary to fasten it to the desired parts by the finest silk sutures. The latter is particularly important, because very often the rectus externus grows onto the Kroenlein incision and thereby remains paralyzed. The bone flap is then replaced as well as possible. It is well to have small sterilized pieces of wood handy with which to mold the lateral orbital wall, should it for any reason be hard to manage. As a rule, manual reposition is sufficient. Both horizontal periosteal incisions are sutured with fine silk.

When suturing the skin incision, one should be careful to get as nearly as possible all the neighboring cell and fat tissues into the first deep sutures, after which the skin wound is closed with superficial sutures. If this is neglected, the skin becomes attached to the bone, and the orbicularis muscle remains permanently weak. Particularly in cases in which a second orbital border incision is combined with the Kroenlein incision, such neglect can lead to an elephantiasis-like severe chronic œdema of the lids.

Tumors in the medial half of the orbit. When the tumor lies in the medial half of the orbit, a second orbital border incision should be made immediately after the lateral orbital wall has been reflected back. The distance of this incision from the Kroenlein incision depends upon the position of the tumor. This step in the technique has already been described. Then the tarso-orbital fascia is incised parallel to the orbital border incision and the tumor freed with blunt forceps and closed scissors, as previously described. The procedure is made easier by mobilizing the eyeball well outward with an orbital spatula, by means of which the operative field is made more approachable. The rest of the procedure has been described; but attention must be drawn to the fact that one must avoid the trochlea and lachrymal sac. When the approach is along the medial and lower wall of the orbit, extreme care must be exercised to avoid injury to the bony wall including the lamina papyracea of the ethmoid, the lachrymal bone, and the roofs of the antrum of Highmore, which are very thin in children and old people and must not be fractured.

EXENTERATION OF THE ORBIT

When a tumor involves the eye muscles or the surface of the eyeball, and it is found at exploratory operation to be malignant with the result that the tumor with the very thick connective tissue capsule and surrounding cellular and fatty tissue cannot be removed, exenteration of the orbit is done.

This can be done in two ways:

1. If the skin is intact, the lids and conjunctiva can be preserved. Then one performs a canthoplasty, and the eyeball is isolated by dissection of the bulbar conjunctiva as for enucleation. An incision is then made with the scissors from the lateral border of the cornea along the entire conjunctiva together with the outer lid commissure up to the orbital border. The incision is continued behind the conjunctiva, above, below, and around, and up to the periosteum, with a scalpel. The periosteum on all sides of the orbit up to the apex is loosened with a rasp and periosteal elevator, and the entire ball of the orbital contents drawn forward and removed with scissors as far behind the probable end of the tumor as possible, directly at the apex of the orbit. A large tampon previously prepared is pressed into the apex of the orbit in order to stop the profuse bleeding from the ophthalmic artery and vein. It is often necessary, if one is convinced by an examination of the extirpated tumor that the tumor is attached to the bone at any point or at the apex of the orbit, and it has not been entirely removed, to remove the corresponding parts of the bone with chisel and hammer, as previously described. It is often necessary to stop the bleeding immediately with the Paquelin cautery. The canthoplastic and conjunctival wounds are closed with silk sutures, a xeroform gauze tampon being led out from the orbit through an opening in the middle of the wound. This can be left in for days. If no fever occurs, it can be loosened after one week and the opening made smaller by compression on the conjunctiva and skin of the lid.

2. If the conjunctiva and skin of the lids are partly included in the tumor, the skin is excised for a distance of about 1 centimeter from the tumor, the normal parts of the lids are incised ½ centimeter outside of the lid border, the remaining skin of the lids is dissected free about to the orbital border, the periosteum is incised on the orbital border and loosened from the bony wall, and from here on the entire orbital contents are removed, as previously described. The tear ducts are removed at the same time, and the tear sac is shelled out of its fossa and removed. After a tampon has been inserted, the skin of the lids must be sutured up to the point where the tampon is led out.

Should the lids be completely destroyed, as often happens when a carcinoma grows out from the lid, the large orbital defect is best covered by a thick Fricke flap clear to the periosteum, slid down from the forehead. The naked periosteum on the forehead is covered with a Thiersch

graft. In such cases, frequently the whole orbit need not be extirpated, the anterior parts of the orbit including the eyeball being sufficient. In most cases a skin prosthesis (wax or rubber) can be inserted directly or fixed by means of spectacle frames.

One naturally decides immediately upon an exenteration when the vision has been seriously impaired by optic atrophy or optic neuritis, or when motion will probably be greatly disturbed by the encroachment of the new-growth upon the eye muscles. Even if the tumor could possibly be made retrogressive by roentgen-rays, still tumor rests might lie hidden in the orbital tissues and grow rapidly or metastasize.

In cases of melanotic tumors of the orbit, the radical total exenteration of the orbit is very probably indicated. The lids must be sacrificed if the new-growth has reached the conjunctiva and the skin of the lid.

In all cases in which the tumor can be suspected of malignancy the operation is followed by roentgen-ray therapy and the patient kept under observation for at least a year.

FROM THE SURGICAL CLINIC, LAKESIDE HOSPITAL

THE TECHNIQUE OF CARDIORRHAPHY

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THE suture of cardiac wounds is the accepted therapy of such disasters. Ten years after his first successful case, Rehn (5) was able to collect 124 cases in which suture had been performed, with 40 per cent recovery. In 1920 Tuffier (9) assembled 305 cases with 50.4 per cent recovery. Smith tabulated 58 cases, collected from the literature between 1912 and 1923, with 66.6 per cent recovery. These figures speak for themselves. They disclose one of the brilliant epochs in the advance of surgery. Although the opportunity to suture a wound of the heart may come but rarely, every surgeon should acquaint himself in the surgical laboratory with the technique of handling the heart and applying sutures to a wound. This is not the occasion for discussing the diagnosis of a wound of the heart. It may be mentioned, however, that cardiac tamponade is of fundamental importance in the diagnosis of the condition and its mechanism should be understood.

ANÆSTHESIA

The choice of the anæsthetic depends upon the individual case. Inhalation anæsthetics do not seem to be harmful. Many cases of cardiorrhaphy and pericardiostomy have been done under local anæsthesia, and many under the various inhalation anæsthetics. Patients with wounds of the heart have been operated upon in a moribund condition without any anæsthetic at the beginning of the operation. The statement should be made, however, that every operating room where such surgery may be performed should be equipped with some form of apparatus for administering positive pressure to the lungs. At the present time most machines used in the administration of anæsthesia, whether ether or nitrous oxide and oxygen, are equipped with a pump through which the gases can be forced under pressure into the lung. When positive pressure sufficient to insufflate the lung is used, it is usually unnecessary to place a tube in the trachea through the larynx, but this also may be necessary. Our experience with the operation of median sternotomy in which the pleuræ are not opened convinces us that in this operation positive pressure is unnecessary. In the use of any of the many parasternal incisions which open the pleural cavity, however, it would seem wise to be prepared for insufflation of the lung.

EXPOSURE OF THE HEART

Adequate exposure of the heart is essential and this in face of the fact that the moments necessary to provide adequate exposure may seem of vital importance to the perpetuation of the heart-beat. When the pericardium is opened and the tamponade relieved, the heart may regain a vigorous action within a few systoles. If the exposure of the heart be inadequate, one may open the pericardial sac, see the heart recover, and then be faced with the terrifying situation of a vigorous heart action shooting out great jets of blood and yet be unable to locate the leaking point. Since Rehn's (5) first successful case of cardiorrhaphy in 1896, much has been written about methods of exposure. The various methods proposed may be grouped into two chief types: (1) median incisions which split the sternum and do not enter the pleural spaces; and (2) parasternal incisions. The parasternal incisions include osteoplastic flaps and intercostal incisions of varying magnitude. They enter the pleural cavity and are especially useful in cases in which there is combined injury of the left lung and the heart. They do not afford full exposure of the heart, because the right auricle and most of the right ventricle are inaccessible by this approach. The median sternotomy incision, though more time-consuming, protects the pleural cavities and affords full exposure of the heart.

A. The median incision (Fig. 1). This exposure was first developed by Milton of Cairo (4). It has been modified repeatedly and in its most satisfactory form has been described by Duval and Barasty (3) as the median thoraco-abdominal pericardiotomy. In this operation the incision lies in the midline anteriorly and reaches from the second rib to within a few inches from the umbilicus. It is carried through to the bone and to the linea alba. The linea alba is divided to the sternum; the ensiform is freed or removed; the diaphragmatic attachments beneath this are separated from the sternum and the index and third fingers of the right hand are thrust upward beneath the sternum to separate the tissues that lie beneath it. Having freed the substernal tissue

as far up as possible, a flat spatula is introduced which protects the underlying viscera. The sternum is then split in the midline to the second interspace. We have found that this can be accomplished most rapidly with a motor driven circular saw, but it may also be done with a pair of large bone cutters, such as Schumacher shears. At the level of the second interspace, the sternum is cut across, either with a saw or with shears. One should guard against injury to structures beneath the sternum by constantly keeping a flat retractor beneath it as it is cut. Great care should also be taken in the transverse division of the sternum so that the internal mammary vessels are not injured. They often lie within a centimeter of the sternal edge. In our experience, the straight cut obtained by the saw is preferable to the jagged cut obtained by a shear, because in closing the wound more accurate approximation of the sternum with silver wire sutures can be obtained. This reduces the amount of pain during the period of convalescence because with each respiration the movements of the cut edges of the sternum are painful.

We have found, as indicated by Milton (4) in his classic paper, that it is better to incline the sternal incision slightly to the left from above downward. This keeps the incision more surely over the "uncovered" tirangle (triangle of safety, Voinitch-Sionojentsky) thus protecting the pleuræ against injury and affords a better view of the left auricle and left ventricle.

After the sternum is split and cut across and the linea alba is divided, the two halves of the sternum can be pulled apart with retractors. As this progresses, the pleuræ should be wiped away with gauze from the anterior chest wall lest they tear when the exposure becomes sufficiently widened. At this stage, full exposure cannot be obtained until the diaphragm is divided. A self-retaining retractor is now placed. We have found the retractors devised by Tuffier or by Lilienthal very satisfactory. The anterior pericardium is widely opened to the diaphragm; the peritoneum is then opened over the liver to the diaphragm, and the abdomen protected with warm moist pads. Care is taken so that the incision travels somewhat to the left, and the inferior pericardium and diaphragm are split inward almost to the crura. When this has been done, the retractor may be opened quite widely.

An excellent exposure of the heart is obtained. The methods for the proper handling of the situation from this step on are described below. After closure of the wound in the heart has been accomplished, the apposition of the parts is completed

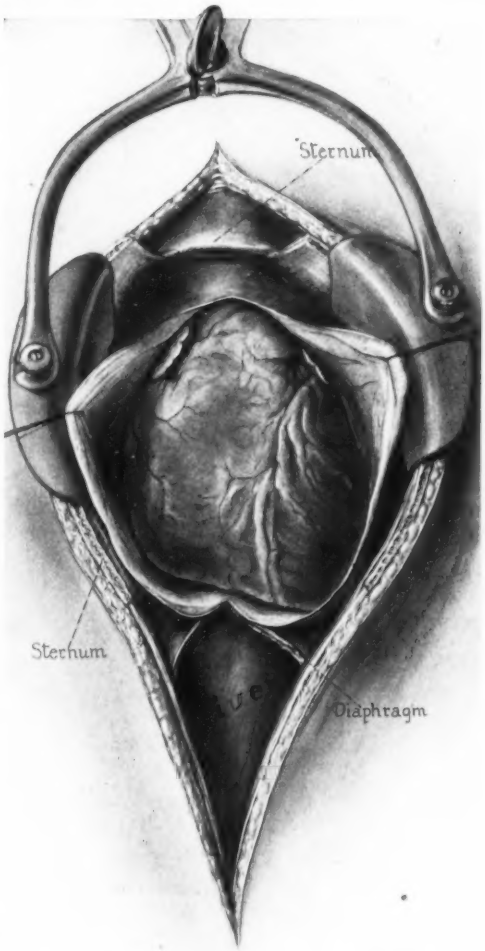

Fig. 1[1]. Exposure of heart by median sternotomy.

as follows: By reducing the amount of traction, the inferior pericardium and diaphragm may be closed with a continuous suture. Then the anterior pericardium is approximated with a continuous suture from above downward, this suture being tied about 1 inch from the diaphragm, so that a small rubber tissue or gutta percha drain may be left in the wound to this point for 24 hours. The retractor is then removed and three drill holes are made opposite each other in each half of the sternum through which silver wire sutures are placed. The

[1] The illustrations are taken from an article by Dr. Beck in the *Archives of Surgery*.

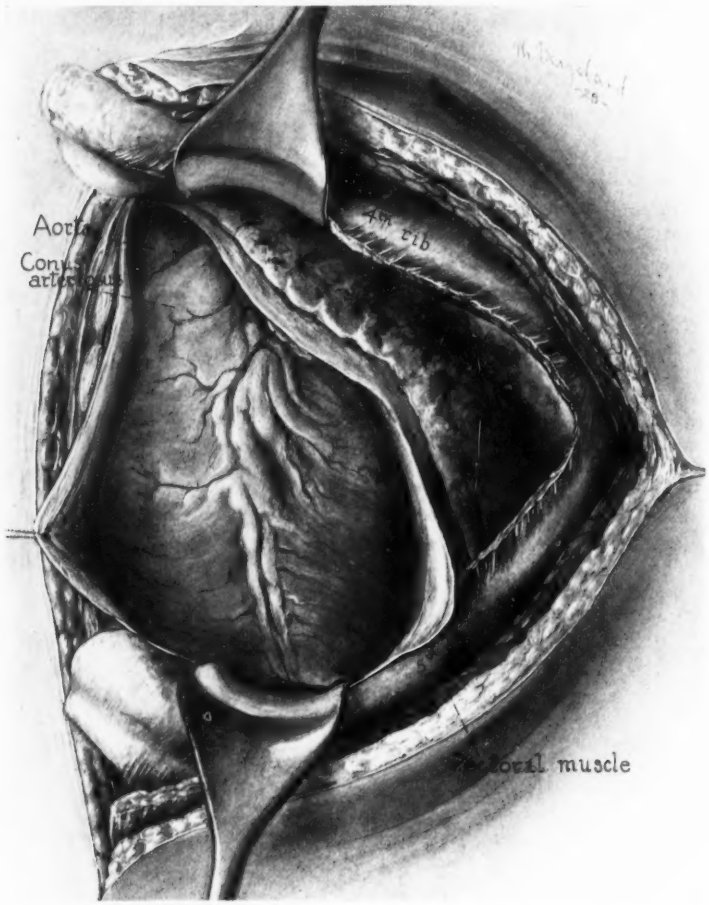

Fig. 2. Exposure of heart by intercostochondral thoracotomy.

linea alba is next closed with interrupted sutures, and the two halves of the sternum are brought together and the silver wire sutures tightened. The skin and subcutaneous tissue may be approximated in layers.

B. The parasternal incision. Operations for exposure of the heart and pericardium were first performed with left parasternal incisions. Larrey used such an exposure in 1810 when draining an infected pericardial wound. Romero, in 1819, drained three cases of purulent pericarditis through a similar incision.

Since that time a great many variations of the left parasternal incision have been developed. They are well reviewed by Terrier and Reymond (8), Matas, and Tuffier. Some authors used a simple intercostal incision, some resected ribs, some turned osteoplastic flaps or "trap doors" in one direction or the other, and some combined these methods with partial removal of the sternum. It seems out of place to give all these procedures in detail here, and we have, therefore, selected from this large group that method which seems to us the simplest and best. The limitations of all lateral incisions have been emphasized. We have selected the Spangaro[1] intercostochondrotomy in-

[1] In his original contribution Spangaro did not include cutting the costal cartilages as a routine part of the exposure. However, he suggested that the incision might well be enlarged by such a procedure and it appears to us that he should have the credit for emphasizing the value of this exposure even in its fully elaborated form.

Fig. 3. First step in method of controlling flow of blood through heart by compression of base: third finger is placed through great transverse sinus; fourth and fifth fingers are placed posteriorly in pericardial cavity; by compression with the fingers the venæ cavæ and the pulmonary veins can be occluded.

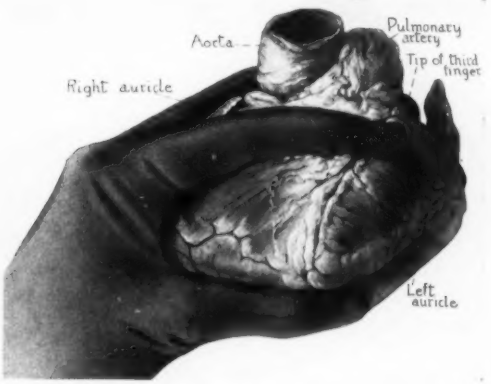

Fig. 4. Second step in method of controlling flow of blood through heart by compression of base; the heart is steadied between the thumb and the index finger.

cision as the most useful among the great group offered (Fig. 2). This intercostal incision with its possible enlargement by division of the costal cartilages at the point of attachment to the sternum was used independently by Durante and Wilms and has received the enthusiastic endorsement of Rehn and Salomoni.

In this procedure, the incision is made in the left fourth or fifth intercostal space, extending from the anterior axillary line to the sternum where it may continue upward and downward along the margin of the sternum to expose the third, fourth, fifth, and sixth costal cartilages. The incision is carried through to the pleura. The internal mammary vessels are isolated, ligated at the upper and lower limits of the wound, and divided between the ligatures. The third, fourth, fifth, and sixth costal cartilages are divided close to the sternum. The incision is then extended through the pleura, the lung being kept distended by positive pressure insufflation if necessary. If there be active bleeding from the lung, it may be advisable to suture the wound of the lung before artificial inflation is carried out, because hæmorrhage is usually less marked when the lung is collapsed. The ribs are then widely separated and held retracted by some form of self-retaining retractor. The pulmonary field can be walled off with warm moist packs. For this purpose, one should use silk handkerchiefs covered with vaseline, or cotton moistened in salt solution. The pericardium is opened according to the lesion present, either longitudinally, which makes closure simpler, or horizontally. It is well to have silk traction sutures on either side of the pericardial wound for identification later and for traction during the operative procedures.

This incision gives excellent exposure of the left lung and the left side of the heart including the left auricle and ventricle. It only partially exposes the right ventricle (Ballance found it ample in his case), offers no exposure of the right auricle and does not give a very satisfactory view of the left auricle. The venæ cavæ are inaccessible and, therefore, one cannot control hæmorrhage by pressure upon the vessels entering the heart at the base. The exposure is sufficient, however, to permit direct compression of the ventricles in the grasp of the operator. The exposure may be enlarged by the removal of a portion of the sternum, and it has even been proposed that the sternum be completely divided transversely.

This method of approach is indicated in cases in which the wound has penetrated the left pleural cavity, in which there is combined injury of lung and heart. The steps to be taken in closing the wound in the heart are described below. Wounds of the lung usually can be controlled by deep mattress sutures, gently tied and approximated. Experience seems to indicate that the pericardial wound should be drained. The pleural wound, however, should be closed without drainage. A running suture will suffice for the partial closure of the pericardium. The retractor is then removed

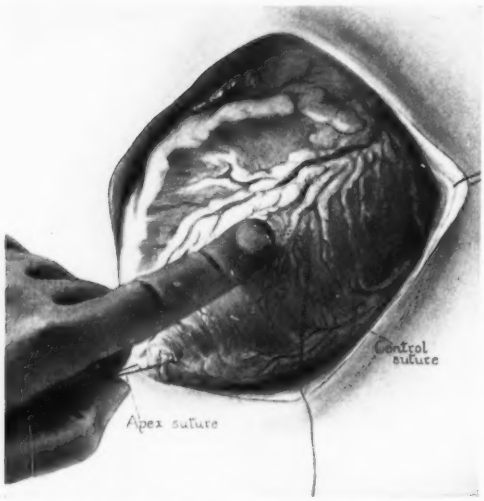

Fig. 5. New method of suture: control of hæmorrhage from the wound preparatory to suture. Showing the suture in the apex of the heart and the position of the control suture; traction on the apex suture steadies the heart so that the index finger can be maintained effectively on the wound; a control suture is being placed.

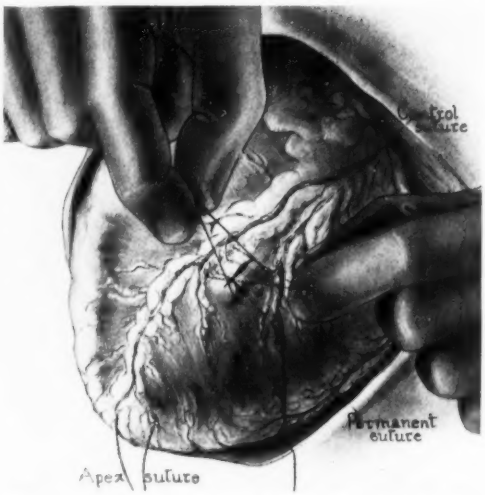

Fig. 6. Second step in new method: the control sutures are crossed and held under gentle traction by the assistant; hæmorrhage can thereby be controlled, and a good exposure of the wound is provided. The permanent sutures can be placed so that adjacent coronary vessels are avoided and a satisfactory approximation of the wound is obtained.

and the ribs allowed to reassume normal position which they will tend to do. The pleura can then be approximated by a running suture which includes the intercostal muscles as well as the pleura. It may be necessary to place one or two silver wire or heavy chromic catgut sutures about the two ribs nearest the opening to make the approximation more secure. Such wounds heal well. A tight swathe adds to the comfort of the patient. Should blood or fluid accumulate in the pleura, it can be removed by aspiration as indicated.

SUTURE OF THE WOUND

The steps to be taken after exposure has been accomplished depend upon the extent, site, and type of injury present. In cases of perforation of the cardiac chambers, the pericardial sac will be found full of blood, and as soon as pressure is released by opening the pericardium, fresh blood will spurt into the wound or engulf the field.

If the injury is very large, it will be necessary to use Sauerbruch's (6) method for the temporary arrest of the circulation while placing the necessary sutures (Figs. 3 and 4). This procedure is carried out as follows: The left hand is placed in the region of the base of the heart, the third finger passing through the great transverse sinus above the cavæ and pulmonary veins and beneath the aorta and pulmonary artery; the fourth and fifth fingers rest on the auricles beneath these structures; as the third finger is approximated to the other two, the flow of blood into the heart is stopped; and, when this has been accomplished, pressure with the index finger and thumb may be exerted to steady the organ and deliver it into the field. Sutures should be placed as rapidly as possible, and with this in mind should be prepared in sufficient number as soon as the operation starts. Great care, however, should be taken not to injure the coronary vessels. We prefer to use interrupted silk sutures, but others have used chromic catgut with success. If much time has been taken during the process of suturing, it is well to release pressure at the base of the heart intermittently so that some blood may flow into the coronary vessels.

If the wound be small, we believe the following method recently described by one of us (2) is far less deleterious to patients and should give more satisfactory control without the danger imposed by the manual trauma of Sauerbruch's procedure. This method is carried out as follows: As soon as the exposure is completed, a suture should be placed in the apex of the heart and the threads held in the left hand of the operator. By means of this suture, the heart can be steadied without compression. The index finger of the left hand is

then placed over the wound to control bleeding. With the blood flow thus controlled, the rest of the procedure may be more deliberately carried out. Two deep sutures should then be placed parallel to the long axis of the wound. As these threads are crossed and made taut, the finger is removed, and the tension exerted by the pull of the threads will control all bleeding (Fig. 5). The situation is then in hand, and the final sutures passing from one side of the wound across to the other may be laid with precision and care (Fig. 6). We have used in our experimental procedures, fine silk threads on French needles and have found this material satisfactory. Such a procedure is of value when the wound is in close proximity to a major coronary vessel the inclusion of which in the suture might result in ventricular fibrillation.

We should like to emphasize that inserting the finger into the cardiac opening is a dangerous procedure. It was found, as pointed out in a previous article (2), that to control the bleeding by this method frequently called forth so much pressure upon the finger that the cardiac muscle was torn, the wound accordingly enlarged, and the difficulties of the procedure augmented. In several experiments, exsanguination occurred before the wound could be sutured. Furthermore, the presence of a finger in the wound added to the difficulty of placing a satisfactory suture. Because of its marked friability, cardiac muscle cannot withstand inclusion in clamps and forceps, and such instruments should not be applied.

We would advise the surgeon to acquaint himself in the laboratory with the handling of the pulsating heart. It will be found that the heart can tolerate manipulation very well, and with experience can be handled much as any other structure of the body. For any manipulation of the heart we should like to emphasize the value of a suture placed in the apex. By means of this suture the heart can be steadied in any position and the index finger can be maintained effectively upon a bleeding wound. Compression of the heart in the grasp of the operator is usually unnecessary as is also shutting off the flow of blood through the heart by compression of the vessels at its base.

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A POINT IN TECHNIQUE FOR THE SUPRAVAGINAL REMOVAL OF A MYOMATOUS UTERUS WITH A FOUL UTERINE DISCHARGE[1]

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WHEN carcinoma of the body of the uterus is present, we make it a rule to sew up the cervix from below prior to going in above and removing the entire uterus. The vagina is then packed with gauze so that the uterus is pushed well up into the abdomen.

Recently at the Johns Hopkins Hospital I had a patient who had a myomatous uterus and a

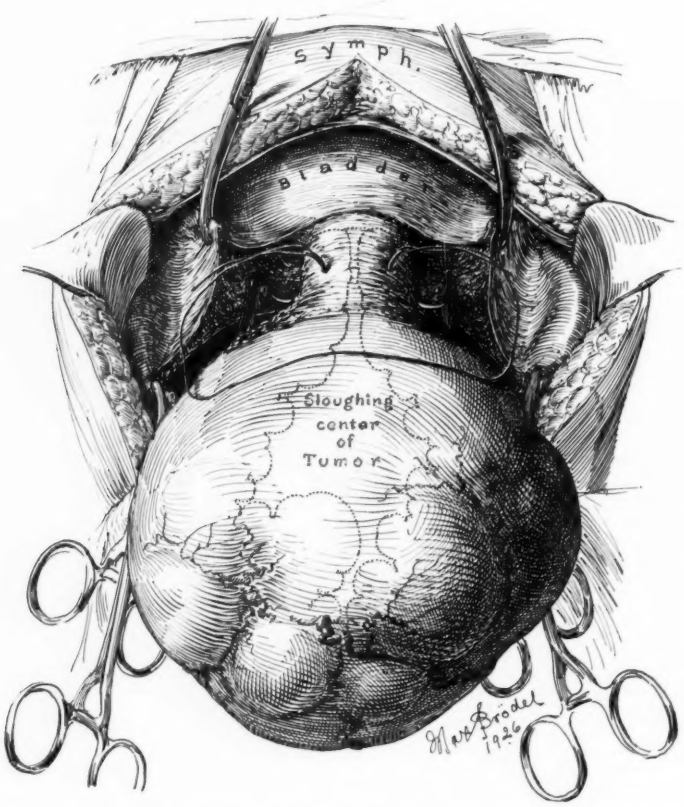

Fig. 1. Passing a mattress suture through the cervix as a preliminary to a supravaginal hysterectomy, to prevent the escape of purulent uterine contents into the peritoneal cavity. (Schematic.) In such a case, whether a supravaginal hysterectomy or a complete operation is done, there is great danger of subsequent peritonitis. In the case reported, speed was essential on account of the patient's weakened condition; and by doing a supravaginal operation considerable time was saved. All vessels have been controlled and the cervix mobilized. A mattress suture of catgut has been placed, each end of the suture being introduced from before backward. The suture is tied behind. (See Fig. 2.)

[1] Presented at the meeting of the Southern Surgical Association, at Biloxi, Mississippi, December, 1926.

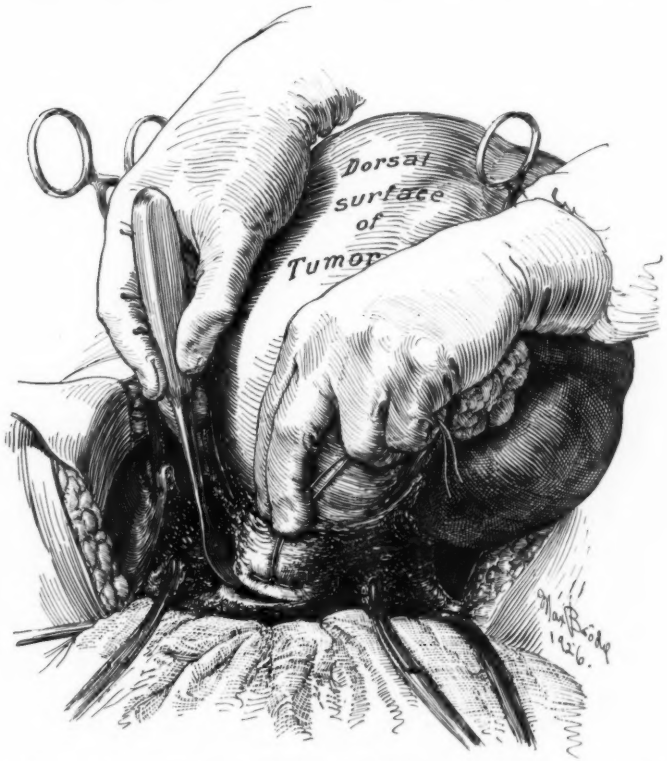

Fig. 2. A mattress suture closing the cervical canal and effectually holding back purulent uterine contents. Viewed from above. (Schematic.) The cervix is being cut across from left to right. Hardly a drop of discharge was seen when the uterus was amputated.

foul uterine discharge. She had suffered from hæmorrhages and the hæmoglobin was 15 per cent. After a purin diet of liver, kidney, and pancreas the hæmoglobin rose to 40 per cent. Notwithstanding the use of radium, bleeding again commenced, the hæmoglobin dropped to 35 per cent and it was necessary to insert packs.

When I saw her there was a most fœtid vaginal discharge and I was afraid that an abdominal operation might cause a general peritonitis. On account of the patient's precarious condition I felt it wiser to amputate through the cervix because this procedure would save a good deal of time. On the other hand, there was danger that the uterine contents might escape as we cut through the cervix.

I finally decided to pass a mattress suture through the cervix and tie it, and thus block the cervical canal above the point of amputation.

After tying off the ovarian and uterine vessels and isolating the cervix I carried the stitch from before backward through the cervix. Then after rethreading the loose end I carried it back through the other side of the cervix. It was much easier to introduce both ends of the suture from before backward. I then tied the suture on the posterior surface of the cervix. The uterus was now amputated below the point of suture and not over a drop of fluid escaped from the cervical canal. The patient made a satisfactory recovery.

The suture is easily placed. Figures 1 and 2 show the manner in which it is applied.

This procedure, I think, will reduce the chance of infection in such cases to a minimum.

THE USE OF IODIZED OIL IN THE DIAGNOSIS OF PULMONARY LESIONS[1]

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In February, 1923, Sicard and Forestier announced their important discovery that a fluid contrast substance, lipiodol, could be safely introduced into the bronchi as an aid to chest roentgenography. Lipiodol consists of poppy oil combined with 40 per cent iodine which renders it opaque to the X-rays. The work of Sicard and Forestier (24, 25) in bronchography was soon confirmed by numerous observers in their own country and by German, Danish, Russian, English, and American investigators.

The American literature contains interesting and instructive reports by Ballon (3), Archibald (2), Clerf (6), Grady (12), Pritchard (22), Whyte, Gordon, Furstenberg and Hickey (11), and others.

In April of this year I presented a paper on this subject (14) and described a specially devised double barreled intubation tube through which the iodized oil can be readily introduced (Fig. 1). I also demonstrated the use of opaque media as an aid in the delineation of subglottic stenosis.

In addition to lipiodol, two other iodine preparations are available. The German iodized oil is marketed under the name iodipin (17) and the Danish preparation has been named iodumbrin (21). All three preparations consist of a vegetable oil combined with about 40 per cent of iodine by weight. I have used all three preparations and have found no marked difference in their radiopacity nor in their effect upon the patient. Iodipin is somewhat more viscous than the other two oils but this viscosity presents no obstacle when the oil is properly warmed.

Recently Dyroff (8, 9) has reported on the (intra-uterine) use of a new preparation, "contrastol" in which bromine instead of iodine is combined with a vegetable oil. He claims that brominized oil is less irritating than the corresponding iodized compound and states that both animal and clinical experiments have proved that contrastol is entirely free from injurious properties.

METHODS OF INTRODUCTION AND ROENTGENOGRAPHY

Before injecting the oil the larynx and tracheobronchial tree must be properly anæsthetized. The oil may then be introduced with a laryngeal syringe or by puncture through the cricothyroid membrane. Beck and Sgalitzer (5) advocate the introduction of a catheter into the trachea, while both Haslinger (13) and Lorey (20) introduce a small bore radiopaque tube which is guided under fluoroscopic control into the lung area to be injected. Josefson (16) attaches a syringe to a tubular tongue depressor the tip of which rests at the epiglottis. The lipiodol is injected while the patient makes inspiratory movements. Singer (26) employs a somewhat similar technique.

Ballon (4) and Clerf (6) prefer the bronchoscopic method. I have also frequently employed the bronchoscope but think it should be used only when cultures or specimens are to be taken or when direct inspection is desirable. I have found my air and oil intubation cannula technique to be very simple and practicable and applicable to both children and adults (Fig. 1).

In most cases the oil is injected under the guidance of the fluoroscope. By varying the position of the patient the opaque fluid may be caused to gravitate into the most dependent portion of the lung, including the apex. The apex is infiltrated by placing the patient on his side. Very frequently the diagnosis can be established from the fluoroscopic image alone. Anteroposterior, stereoscopic, and lateral views should usually be taken. It is sometimes advantageous to take films with the patient in both the upright and recumbent position, especially when fluid levels are to be demonstrated.

From the combined experience of many observers sufficient data have been accumulated to enable one to properly evaluate this method of diagnosis. The limitations of the method as well as the indications and contra-indications to its use have been fairly well established.

BRONCHIECTASIS

The most brilliant results have been obtained in the detection of bronchiectatic cavities which very frequently are not discernible on the ordinary X-ray film. Since these cavities are almost always situated in the lower lobe of the lung, which region may be injected with the greatest ease, the clinical diagnosis of bronchiectasis may be confirmed or disproved with reasonable certainty. The various stages of the disease from its early manifestations to its full blown development may now be studied

[1] Read before the Clinical Congress of the American College of Surgeons, Montreal, October 28, 1926.

Fig. 1. Double barreled air and oil intubation tube *in situ* (II), rubber tube projecting from the patient's mouth and attached below to the oil channel (III). The oil is injected through the rubber tube, with the patient in any position desired.

in the living. Furthermore, the introduction of iodized oil frequently has a favorable effect upon the clinical course of these cases as reported by Abramowitsch and Tichomirow (1) and others.

In bronchiectasis the earlier lesions appear upon the film as cylindrical dilatations of the smaller secondary bronchi. The more advanced lesions appear as club shaped, fusiform, sacculated or grape-like distention of the involved bronchi and bronchioles (Fig. 2). The lesions may be unilateral or bilateral. The unilateral cases often give a history of a previous pneumonia or an empyema in the affected area. In the bilateral cases the lesions on one side are usually much more advanced than on the other. A site of predilection is found in the lung field situated behind the heart shadow, a region which hitherto has been almost a "no man's land" to both internist and roentgenologist (Fig. 3).

This method of diagnosis has also shown that the bronchiectatic process may begin during childhood, as demonstrated by Delille (7), who detected a series of cases of bronchiectasis in children who had been confined in a tuberculosis sanatorium under a mistaken diagnosis of tuber-

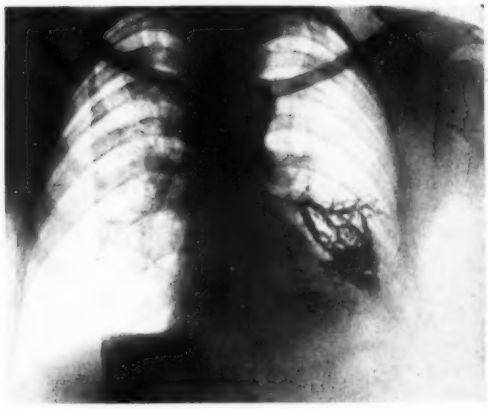

Fig. 2. Veteran of the World War, aged 38. Dull pain in chest. Shortness of breath and profuse expectoration since 1917. Examined in U. S. Diagnostic Center No. 1, in 1926. Diagnosis of lung abscess complicated by bronchiectasis, confirmed by lipiodol injection.

culosis. My youngest patient was a girl of 13. Her history indicated that the disease process had begun 6 years before, following an attack of influenza (Fig. 4).

TUBERCULOSIS

Because the lesions of pulmonary tuberculosis are multiform, the injection of iodized oil reveals some very unusual pictures which are often not visible in the ordinary films. The trachea will frequently be found to deviate markedly from the midline owing to the traction of a fibrotic upper lobe. The left main bronchus may be hooked up by a similar traction force so that it becomes curved with the convexity downward. I have ventured to call the pseudo-cavity thus formed a reservoir bronchus. Not infrequently small and sometimes even large cavities will be revealed for the first time after injection. On the other hand, at times, known cavities cannot be filled with oil probably because of the absence of a wide drainage bronchus.

Injections have demonstrated the frequent occurrence of small bronchiectatic cavities in the tuberculous lung. These may be situated in the upper as well as the lower lobes (Fig. 5). Such cavities are in all probability a secondary manifestation of the disease process. The line of demarcation between a thickened pleura and an infiltrated lung can be demonstrated to advantage.

Finally the injected lungs give the thoracic surgeon valuable information as to the comparative condition of the two lungs before and after

the surgical procedures now so commonly employed in the treatment of pulmonary tuberculosis.

Notwithstanding the advantage of the increased visibility in the tuberculous lung after injection, experience has shown that such a lung cannot always be injected with impunity. This is especially true since some of the frequent complications of pulmonary tuberculosis may be attributed falsely or otherwise to the introduction of the opaque medium.

The early investigators of lipiodol expressed some fear that the endobronchial injection of the oil into the tuberculous lung might activate the disease process or set up congestion and excite hæmorrhage, and therefore they usually refrained from making such injections. Forestier, however, on his visit to this country expressed no such opinion and showed no hesitancy in making the injections in the cases of tuberculous patients. Both Ballon and Archibald, in a series of cases, employed lipiodol freely for diagnosis and as a guide to thoracic surgery. Recently, however, they have established special indications for its use.

Jacobaeus (15) expresses no misgivings as to its use in the tuberculous and finds it valuable as an aid in chest surgery. For example, he refrains from severing pleural adhesions when the lipiodol demonstrates that the adhesions are intimately connected with the underlying bronchi.

The only recorded microscopic postmortem studies of the effect of lipiodol in the tuberculous pleura and adjacent lung tissue are those of Fiessinger and Lemaire (10). The lipiodol had previously been injected into the tuberculous pleural cavity. They found that the lipiodol does not penetrate the organized tuberculous lesions but that cells filled with lipiodol enter infiltrated areas. They state that it is possible that this absorption of lipiodol favors parenchymatous sclerosis, but this fibrosis is accompanied by a congestion more diffuse and much more marked than one observes in ordinary pulmonary sclerosis. It does not produce true fibrosis of the tuberculous lesions themselves but only a neighboring sclerosis. Their observations indicate that in an area of active evolution the lipiodol may favor the diffusion of the lesions.

Lichtwitz (19) reported a single case of pulmonary tuberculosis previously rather stationary in which 4 cubic centimeters of lipiodol seemed to activate the disease, and urged caution in employing it in this class of cases.

Personally I have been actively associated with and have been able to follow 13 cases of pulmonary tuberculosis and 2 cases of tuberculous pleurisy in which iodized oil was introduced into the bronchi. Eleven of these cases were sanatorium patients. Eight were kept under observation by Dr. W. C. Breidenbach of the Dayton Sanatorium and 3 were observed by Dr. H. K. Dunham and Dr. Vera Norton of the Cincinnati Tuberculosis Sanatorium. I have notes on the 4 remaining cases of the series. While it is beyond the scope of this paper to consider these cases in detail, it may, however, suffice to enumerate the sequelæ which may have had some relation to the injection.

One case under sanatorium care for approximately 4 years showed a large basal cavity previously undiscernible in the X-ray. The patient improved after the first injection and requested a second treatment with lipiodol. Following the latter he had a very considerable reaction, then improved rapidly but succumbed to a hæmorrhage one month after the last injection. A second patient showed blood in the sputum for several days after injection but subsequently did very well, and is still improving.

A bed-ridden patient with a history of an acute extensive pulmonary involvement of uncertain origin and nature, showed tubercle bacilli for the first time after the iodized oil had been introduced. The patient died 10 weeks later but it is doubtful if the injection hastened the end.

A case with a thoracoplasty suffered considerably from a flare-up of an old myocardial insufficiency. Another patient with an artificial pneumothorax was "very dyspnœic for many days following the injection as would naturally be expected with one lung completely compressed and the lipiodol invading the air spaces of the opposite lung."

A very interesting observation was made in 3 cases (1 mentioned above) in which tubercle bacilli appeared in the sputum for the first time after injection, thus establishing the diagnosis in 2 cases and confirming it in the third. This reaction is doubtless comparable to the release of tubercle bacilli by the therapeutic administration of potassium iodide and may prove of value in doubtful cases.

The remaining cases showed no permanent sequelæ which could be attributed to the oil. Several of them had a febrile react on, lasting from 1 to 10 days, after which several patients showed considerable improvement.

Viewed as a whole this series of cases is not very encouraging. While the sequelæ noted above may not have been due to the introduction of the oil and might readily have occurred in the natural

Fig. 3. Lateral view showing numerous sacculated bronchiectatic cavities in the retrocardial lung field. Chief complaint, arthritis since 1918. Empyema and rib resection in 1913. Patient of Dr. K. Haly.

Fig. 4. Lateral view showing retrocardial club shaped bronchiectatic cavities in a girl aged 13. The history indicates that the disease process began 6 years ago, following an attack of influenza.

course of the disease, still they throw the burden of proof on the operator. I can, therefore, only agree with Dr. Breidenbach when he says: "It would be well to adopt the following rule on the use of lipiodol in tuberculous cases, that while it is not absolutely contra-indicated in tuberculosis, still there should be some defin te end to be gained, for instance, the demonstrat on of a difficult cavity, etc., rather than just general information as regards lung structure." It is also contra-indicated in cases of active tuberculosis.

The employment of brominized animal oil is still in the experimental stage. The recent preliminary report of Putnam (23) indicates that brominized oils are less irritating than similar iodine combinations and that halogenated animal oils are "less irritating, more easily emulsified, and more quickly absorbed than the vegetable oils at present in use." If these experiments are confirmed by clinical experience, it may be found advantageous to substitute these newer preparations especially in tuberculous subjects.

LUNG ABSCESS AND FISTULA

It is rather difficult to fill the cavity of a lung abscess. Unlike the tuberculous or bronchiectatic cavity the pulmonary abscess does not stand open and probably drains chiefly by overflow. As a result the injected oil cannot enter the space already filled with purulent secretion. In lung abscess in particular, the use of the bronchoscope is invaluable since the pus may be aspirated through the bronchoscope and the opaque medium may then be introduced with greater ease and certainty than by other methods. The easy filling of an abscess is one indication that the abscess may be amenable to treatment by bronchoscopic aspiration. When the abscess is situated in the periphery of the lung and has poor drainage into the bronchi it may be found impossible to inject the cavity.

On the other hand if the cavity has been opened and is draining through a fistula in the chest wall, injection of the opaque medium through the fistula will give an excellent delineation of the cavity and its connections (Fig. 6). It is important to inject the fistulous tract with a local anæsthetic before the oil is injected, in order to abolish the cough reflex and thus prevent the expulsion of the opaque fluid. The fluoroscope should be employed while the injection of the opaque medium is being made.

Fig. 5. Pulmonary tuberculosis showing traction displacement of the trachea toward the right side with numerous small bronchiectatic and tuberculosis cavities in the upper lobe.

Fig. 6. Bronchiectatic and pulmonary abscesses injected through a catheter, (indicated by arrow), inserted into a thoracic fistula. Patient of Dr. George Heuer.

In the same manner bronchopleural fistulæ may be delineated to great advantage. The injection of the iodine may prove beneficial. In a case reported by Moeller and von Magnus (21) the fistula which had a very slight tendency to heal closed within 3 weeks after the injection.

TUMORS

When tumors of the pleura or lung parenchyma are present, the injected bronchi usually either terminate abruptly at the site of the tumor or seem to be pushed aside by the growing neoplasm.

In mediastinal growths just below the tracheal bifurcation the angle of bifurcation may appear considerably wider than in the normal (Lenk, Haslinger, and Presser, 18).

PLEURISY

In a case of pleurisy with effusion the injected lung, if free, will be seen to be floating on the effusion and the limits of the effusion may come out clearly on the film. When the X-ray failed to determine the localization, extent or biloculation of the effusion, Fiessinger and Lemaire (10) employed an ingenious method of delineating the upper and lower borders of the effusion. They injected a heavy and a light lipiodol into the effusion. The heavy oil sank to the bottom of the exudate while the light oil floated at the top. The use of lipiodol in the study of the structure of pleuritic adhesions in artificial pneumothorax cases has been mentioned above (Jacobaeus).

SUMMARY

1. The use of iodized oil as a contrast medium is of great value in chest roentgenography.

2. The oil may be introduced perorally by several methods including the use of the laryngeal syringe, the special intubation tube, the bronchoscope, and the flexible catheter. It may also be introduced by puncture through the cricothyroid membrane, but this method is not recommended.

3. The bronchoscopic method is preferable when specimens are to be taken, abscesses are to be evacuated, or direct inspection is desired.

4. Injection under the guidance of the fluoroscope gives visual control and frequently establishes the diagnosis before films are taken.

5. The most gratifying results have been obtained in the detection of bronchiectatic cavities.

6. The multiform lesions of pulmonary tuberculosis are usually extraordinarily clearly shown.

7. Experience indicates that iodized oil may at times activate tuberculous lesions. Therefore, in tuberculosis it should be used with caution and only when some special information is to be gained, for example, such information as is desirable before thoracic surgery is undertaken.

8. Brominized oil is less irritating than iodized oil and future experience may show that its use is to be preferred especially in tuberculous patients.

9. Injected iodized oil is of considerable value in the diagnosis of pulmonary abscesses, fistulæ, tumors, and pleural effusions.

I desire to express my appreciation to Dr. Samuel Brown and Dr. George Benzing for their painstaking roentgenographic work in connection with this paper.

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THE METHOD OF CHOICE FOR THE CORRECTION OF SADDLE NOSE[1]

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IN this paper, I desire simply to relate the results of my personal experience for the correction of saddle nose, and to discuss the arguments which underlie my opinion. At first I will say that, for this kind of operation, I prefer to practice autoplasty by means of costal cartilage. Indeed, since the war particularly, almost all the surgeons have abandoned the metallic prosthesis (gold, silver, platinum, aluminum), for reasons which are now well known to us.

White vaseline (Gersuny, 1900), and paraffine (Eckstein, 1901),—and later on a mixture of these two substances,—gutta percha, and rubber have been with reason put aside.

Rueda's attempt (1913) to introduce under the skin a bundle of catgut for the correction of saddle nose had no imitators.

The same can be said of periosteum (Reverdin, 1879), muscle (Vignard), and fascia (Fritz Koch, 1914), because all these grafts, as well as catgut, are absorbed more or less rapidly, and as a consequence do not give any æsthetic result.

Besides the inorganic substances already referred to, I must also mention celluloid which has had a certain vogue for many years. In 1890, Fraenkel began to use it for cranioplasty. In rhinoplasty it was Föderl who employed this substance the first in 1903. If this foreign body is often tolerated by the tissues of the nose, we must however admit that it is a little irritating, and that in many circumstances, it is sooner or later eliminated.

In 1918, Joseph of Berlin, the great initiator of nasal plastic surgery in Europe, advocated ivory for the correction of saddle nose. This organic material is now well known to us, especially since the researches of Carnot who has demonstrated that its chemical composition very much resembles that of human bone. However, it is well to remember that there is on the market an inorganic pseudo-ivory having a vegetable composition which is liable to produce irritation, and must not be employed. Pure ivory can render great service, because it is generally well borne, after having been encapsuled by fibrous tissue. In other circumstances, on the contrary, even if the operation is performed according to perfect aseptic principles, it produces a mechanical irritation and is not tolerated. Being very hard, this prosthesis must be manipulated with saws, rasps, and other special instruments, and for this reason, we must admit that its use is rather complicated.

As to animal grafts, it is recognized by all authors that they are always absorbed, and are replaced by fibrous tissue of new formation, which gives no cosmetic result, or at best a very poor one. In order to make these animal grafts more resistant, Magitot conceived the idea of immersing them in a 20 per cent formalin solution for 8 or 10 days; nevertheless I believe that before their stability is established, they must undergo the test of time.

Israel, in 1895, first employed the tibial crest in rhinoplasty. Since then, especially in Germany, the osteoperiosteal fragments, taken preferably from the leg, are in favor and are commonly employed. In order that the bony graft may succeed, it is essential that it be placed in contact with the nasal bones, and that the operation be performed in an entirely aseptic manner. Even if these two conditions are fulfilled, we often observe partial or total resorption, whether this graft is, or is not covered with its periosteum. Should an error of asepsis occur during the operation, the transplant suppurates and is invariably eliminated in full.

To Nélaton, in 1904, belongs the credit of having introduced the use of costal cartilage for the correction of saddle nose, inspired by the works of von Mangold who, in 1899, was already employing this substance for autoplasty of the larynx and trachea. From all points of view, this cartilage is ideal for this kind of surgery. Indeed, it is very simple to obtain and offers no danger of any complications. It is much more easy to model than bone, or any other organic or inorganic substance. Among all the foreign bodies enclosed in the nasal pyramid, it is the least exposed to infection. Tolerated in a perfect manner, it maintains the æsthetic appearance given at the time of operation. In 1913, J. S. Davis, of Baltimore, having made numerous transplants of costal cartilage on dogs, observed that these grafts—which in certain cases had remained during nearly 2 years—did not increase in volume, did

[1] Read before the Section on Oto-Rhino-Laryngology of the American College of Surgeons, Montreal, October, 1926.

not absorb, and that there was practically no sign of microscopic degeneration, whether the cartilage was or was not covered by its perichondrium. My regretted master, Morestin of Paris, one of the most skillful and expert operators in Europe, in plastic surgery of the face, also shared this opinion. Although some observers have found that after a certain length of time these transplants have a tendency to transform themselves into fibrous tissue, no one has claimed that they diminish in volume, which, from the cosmetic point of view, is most important. Furthermore, to increase their resistance, we know it is better to insert the grafts with their perichondrium. Naturally, the cartilage of the septum or of the ear, employed for the correction of small depressions of the nose, is much more liable to disappear than the large or small cartilaginous costal grafts, and experience has proved that such is nearly always the case.

When it is necessary to take a graft, almost all authors advise the sixth, seventh, or eighth rib. Following this operation, the pain is considerable, and the costal break takes much time to repair, therefore a certain number of patients refuse this kind of autoplasty. For many years I have used for the correction of saddle nose, the cartilage of the first floating rib. This cartilage that we can seize and freely move with the fingers, in the greatest number of patients, is very easily resected. The necessary incision for the removal is very small. Entirely covered by its perichondrium, it offers more resistance to fibrous transformation than any other transplant. For those patients who refuse general anæsthesia, the taking of the graft can easily be done without pain under local anæsthesia. If, in certain cases, the nasal concavity is so marked that we fear we will not be able to fill it with the cartilage alone, it is very simple to cut the entire rib. Carter of New York claims to obtain excellent results in rhinoplasty in employing osteocartilaginous grafts. For these reasons, I strongly recommend the use of the cartilage of the first floating rib, for the correction of saddle nose, as being the method calculated to give the best success. Moreover, we can assure our patients that after the operation, the side will not be very painful, thanks to the compressive bandage, and that at the end of 8 or 10 days they will be practically cured. During and since the war, I have many times used this technique, and I can honestly say that so far, I have not had any set-backs. In support of what I have said, here are now 2 cases briefly reviewed.

Fig. 1.

Fig. 2.

CASE 1. On January 19, 1925, A. B., 32 years of age, male, came to consult me for a saddle nose. He stated that twelve years ago he was struck by a baseball on his nose, which was perfectly straight until then. The hæmorrhage was treated by a general practitioner. About 3 weeks after the trauma, the inflammation going from bad to worse, a rhinologist made an incision for a suppurative hæmatoma of the septum. This hæmatoma healed up rapidly, but later on he noticed that his nose was becoming more and more concave. As the nasal fossæ were obstructed after the accident, he had a minor operation on both sides of the septum 3 years ago. The intervention, performed with a saw, improved the breathing. The patient presents no manifestation of acquired or hereditary syphilis.

At the examination I found a symmetrical concavity of the lower third of the nasal pyramid. The lower part of the nasal bones is slightly flat (Fig. 1).

Anterior rhinoscopy showed a septum absolutely straight. However the septum opposite the trauma was a little thickened. As the turbinate bones were not hypertrophied, the breathing was not obstructed. Rhinitis and pharyngitis were shown by posterior rhinoscopy.

In face of this lesion, I explained to my patient the different means for the correction of his saddle nose, and we decided to have recourse to the costal cartilage. The intervention was fixed for January 23 and I prescribed a nasal antiseptic salve.

As it was agreed that I should employ a piece of cartilage, I had to choose the spot best suited for its introduction. The operation of von Mangold (1889) which consists in making a cutaneous incision between the eyebrows at the inferior concavity, and forming a tunnel under the skin of the nose for the reception of the graft leaves, it is true, a slightly apparent scar. However, if there is even a slight infection, the drainage is rendered practically impossible, because the opening is above, and the graft is in danger of being eliminated.

Carter of New York, in 1910, modified von Mangold's method, by making a curvilinear incision at the superior concavity, as deep as the periosteum, which in turn was sectioned in a horizontal plane, and a recess made toward the glabella. The subcutaneous tissues being afterward freed as far as the tip of the nose, the graft

was placed in such a manner that its superior extremity lay under the periosteum of the nasal apophysis of the frontal bone. In 1919, Carter abandoned this method, and adopted the endonasal route for the reason of drainage, as I have just mentioned.

In an effort to hide the cicatrix, Leon Dufourmentel, in 1919, conceived the idea of making the incision in the eyebrow. Frank and Strauss, in 1921, described exactly the same method as new. Drainage by this method was also impractical. Owing to the length of the incision, and the tunnel for the graft, the operation and any manipulation of the transplant are rendered difficult.

In 1898, Monks of Boston advocated making an anteroposterior cutaneous cut under the tip of the nose, extending slightly to the skin over the columella, and afterward making a tunnel from below upward. J. D. Lewis, in 1922, tried to take as his own Monks' method, making slight modifications. He carries the same incision, but a little more posterior, opposite the columella, and in detaching the skin of the nasal pyramid, he prepares, at the tip of the nose, a point of support for the inferior extremity of the graft when placed.

In order to reach the part of the nose to be repaired, Portmann of Bordeaux (1923) made a curvilinear incision of about 3 centimeters, which passed below the tip, and then separated the tissues.

Always with the same idea, and to obtain more space, Gillies of London (1923) detaches all the skin over the columella, in making an incision at the philtrum and at its junction with the mucous membrane of the nostrils, and after having lifted this flap, he forms a canal under the pedicle. I will say that with Monks', Portmann's and Gillies' methods, the cicatrix is at first almost invisible. However, considering the form of the nasal vestibule, very narrow at its superior part, and the thinness of the skin which covers the tip of the nose, I would very much fear that in separating the tissues of the nasal pyramid—even after the dilatation produced by novocain and adrenalin—the mucous membrane of the nostrils might be torn, an occurrence which would expose the patient to a secondary infection, and to the elimination of the graft. In my opinion, these methods should be reserved rather for the correction of thin hump noses, because in these cases, even if the wound became septic, there would then be no serious consequences, in view of the ease of drainage.

The endonasal incision made at the inferior border of the triangular cartilage, advised by J. O. Roe of Rochester, New York, in 1887—the first to correct the different varieties of nasal deformities—represents, without any doubt, the ideal method now employed by a very great number of rhinologists in America and Europe. Indeed, this process evidently leaves no trace of exterior cicatrization. It presents no danger of complications, being at the same time easy of execution, especially if we use the Joseph's concavoconvex knife to tunnel, at the tip of the nose, a recess with which to anchor the inferior part of the graft. If the nasal fossa, through which the incision is made, has been prepared in an aseptic manner, there need be no fear of infection. At first we might perhaps think that the suture of the lips of the incision might offer some difficulty. Such is not the case, if we use the Dupuy-Dutemps needle, curved at a right angle to its handle, with hemispheric form, which he employs for the dacryocystorhinostomy. Furthermore, Joseph of Berlin, one of the cleverest and most skillful operators of our day in rhinoplasty, who commenced in 1898 to use the external method of correcting nasal deformities, has since 1904 used only the internal route. Because of all these considerations, and my personal experience, I chose for my patient this last method.

Operation. After having cut the hairy follicles of the vestibule, irrigated the nostrils, and applied tincture of iodine, I injected a solution of novocain and adrenalin. A few minutes later, I incised the mucous membrane of the left side, at the inferior border of the triangular cartilage, and fashioned a tunnel for the graft, at the same time preparing a support for it at the tip of the nose. The patient was afterward chloroformed, and I removed a piece of the cartilage from the first floating rib, on the right side. This graft, carefully shaped, was placed under the skin of the nasal depression. After having squeezed out the blood, I sutured the incision with silk. Iodoform gauze in the nostril exerted slight compression; and in order to steady the graft, I placed externally, transversely to the nasal pyramid, 2 small bands of adhesive. Then I covered the face with a protective dressing. The costal wound was closed with three layers of sutures, and the ordinary abdominal dressing applied. Postoperative sequelæ were most simple, and from the seventh day, I gradually removed the stitches. Just a slight sensitiveness was felt during the first week, and the patient left the hospital 16 days after the operation absolutely satisfied with the result obtained. His nose is straight, as can be seen from the photograph (Fig. 2) taken one month after the rhinoplasty. I have seen him recently, and his æsthetic appearance has not changed.[1]

CASE 2. C. L., male, aged 24 years, came to see me on April 27, 1926, for sunken nose. He said that he had never received a trauma, and that since birth, his nose had always had this shape, the deformity increasing with growth.

On examination I found a flatness of the nasal bones, and a depression at their lower border. The tip of the nose, tilted up and soft, had no support. The nostrils were much dilated, especially the left one, a condition which

[1] This patient was presented cured before the Société Médicale de Montréal, January 17, 1925.

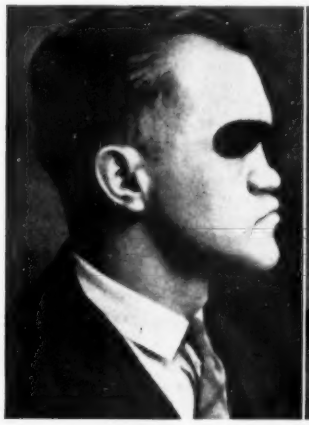

Fig. 3.

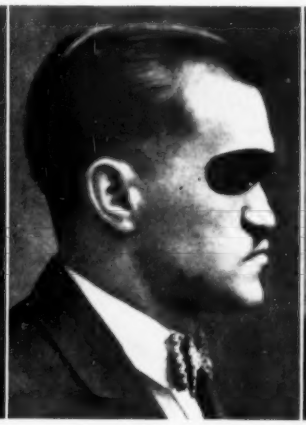

Fig. 4.

Fig 5.

gave the patient a negroid appearance. The lips were very prominent, also the chin (Fig. 3).

By anterior rhinoscopy, I found that the two cavities were very large. The septum was straight, but presented at its anterior part no cartilaginous resistance. The head of the inferior turbinate bones was slightly atrophied, and there existed a double chronic rhinitis with abundant non-odorous secretions.

Posterior rhinoscopy showed a pronounced pharyngitis.

The condition of the tonsils and of the larynx was normal.

The patient had suffered from a chronic suppurative otitis media since the age of 4 years.

I found no sign of acquired or hereditary syphilis, and there was no tuberculosis in his family.

I therefore had to deal with a case of arrest of congenital development of the nasal skeleton, which had to be corrected. Again this time, I explained to the patient the various methods at our disposal for a successful result, and we decided to take a piece of costal cartilage, and introduce it by the endonasal route.

In the presence of this deformity, I considered Moulonguet's method (1920) which consists in making, by the external route, two incisions, one transverse under the tip of the nose, and another anteroposterior through the skin over the columella, the first being joined at its middle. After having made a subcutaneous canal, and splitting the septum, the author takes from the ninth rib a cartilaginous graft which he cuts into the shape of a square. This graft, applied in the operative wound, supports the tip of the nose, and at the same time, corrects the saddle-back. However, in my case, the lack of development and the thinness of the nasal septum would have rendered the operation very laborious, and the slightest lesion of the mucous membrane, on account of the hypersecretion in the nostrils, would have surely produced infection, and consequently the elimination of the graft.

Sheehan's method could have been equally well applied. It consists in making an anteroposterior incision through the middle of the skin over the columella, from the tip of the nose to the philtrum. Having prepared a tunnel, Sheehan then inserts a piece of costal cartilage bent at a right angle at the tip of the nose. This graft has for its object, like Moulonguet's operation, the support of the tip of the nose in a good position, and moreover the filling up of the nasal depression. I have not adopted this method for the same reasons that I have already mentioned in connection with the question of the external incisions. Also, as a simple piece of rib well placed could give me the same cosmetic result, I adopted this method, and fixed the operation for May 6.

Operation. Having followed the same operative technique for my 2 patients, I will not further repeat myself, and will simply say that in this latter case everything turned out quite as normally as in my first case. When I inserted the graft in the nasal depression, I was careful to see that the pressure was on the most concave part—the graft being cut in consequence—in order not to lower the tip of the nose, but on the contrary to slightly raise it. Fifteen days after the rhinoplasty, the patient returned to his family absolutely cured, after having suffered very little from his side during the first week. I continued to sterilize the nostrils with a salve, and on June 7, my patient came again to the hospital to undergo the same day an operation for the correction of the dilated nostrils. The operative field having been made aseptic, I injected a solution of novocain and adrenalin into the nasolabial folds. Instead of using the concavoconvex scissors to cut the nostrils, a method usually employed in the United States, I chose the bistoury, controlling the incision with the finger in the nasal fossa. Thus practiced this incision is much neater than that made with the scissors which have a tendency to crush the tissues; the coaptation is better, and the æsthetic result is more perfect. Also I removed from the two alæ of the nose a little triangular piece with

its base below, limited by the nasolabial folds. At first I operated on the right side, the least dilated, and removed on the left a flap a little larger in order to obtain a symmetrical correction proportionate to the broadness of the face. I sutured with silk and adjusted an internal and external nasal dressing. I obtained a union by first intention, and the patient returned home 10 days after the second operation. The incision, hidden in the nasolabial folds, was hardly visible, the nostrils were narrowed, while allowing good breathing, and the nose itself was quite straight, as can be seen by Figures 4 and 5 made 3 months after the first rhinoplasty.

I have suggested to my patient diminishing the prominence of his lips by removing two ellipses of buccolabial mucous membrane on a horizontal plane; however, he refuses, declaring himself much pleased with the result.

CONCLUSIONS

For the numerous reasons that I have just mentioned, the ideal method for the correction of depressed nasal deformities consists in making an internal incision, and after having prepared a tunnel, inserting a piece of the cartilage of the first floating rib. When the graft is placed in position, the application of two little bands of adhesive transverse to the nasal bones would have the effect of fixing it, and consequently offer better conditions for adhesion with the surrounding tissues. Carried out in this manner, the operation will give greater chances of success than any other method.

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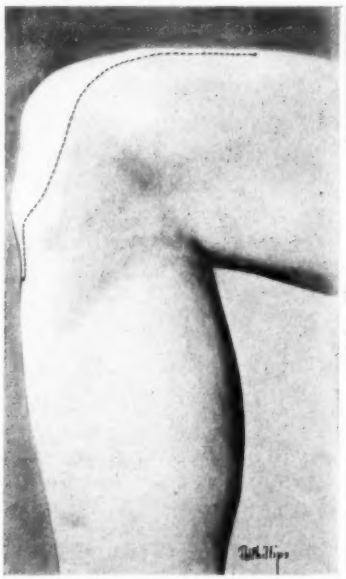
A SUGGESTED METHOD FOR THE REPAIR OF CRUCIAL LIGAMENTS OF THE KNEE[1]

By C. F. EIKENBARY, M.D., F.A.C.S., Seattle, Washington

THE method described of repairing either the anterior or posterior crucial ligament of the knee is suggested as an improvment over either the Hey Groves or the Putti method. The idea of this was first suggested to me by Dr. Langworthy, of Spokane, who designed an operation for the repair of the anterior crucial ligament, whereby he made use of the ligamentum patella. To repair a crucial ligament, it is necessary to have a rather wide exposure of the knee. This can be achieved perfectly well by the so-called Fisher incision, which is a very long incision extending along the inner border of the patella. The patella, together with the soft structures on the inner side, as well as the tissues external to the incision, is displaced laterally and the knee flexed, and in this way a most excellent exposure of the knee is made (Figs. 1 and 2).



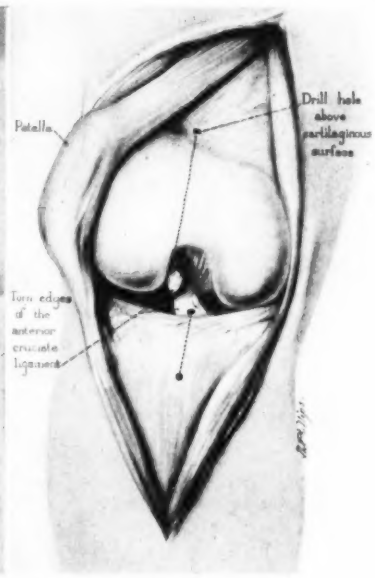


Fig. 1 (left). Position of the knee, and the Fisher patella displacing incision.
Fig. 2. The patella displaced—the dotted line showing the line of drill holes for the insertion of the anterior crucial.

By means of a rather large drill—one-quarter inch—a hole is bored through the anterior portion of the tibia, starting approximately 1 inch below the joint line and going upward and backward, emerging in exactly the center line of the tibia and approximately one-quarter of an inch from the anterior edge of the joint surface, not going through the cartilaginous portion. Another hole is now bored, by means of the same sized drill, starting well above the cartilaginous surface of the femur and practically in the center line, going downward and forward and emerging on the outer side of the intercondyloid notch, at a point where the anterior crucial is normally inserted. A piece of fascia lata, 5 inches long by three-quarters of an inch wide, is now used to form the anterior crucial. This can be pulled through the holes, either by a wire loop or a heavy piece of silk sutured to the end of the rolled fascia (Figure 3). The ends of the fascia projecting through the femur and the tibia can now be sutured firmly in position. The type of suture material used here is

[1] Presented before the King County Medical Society.

Fig. 3.

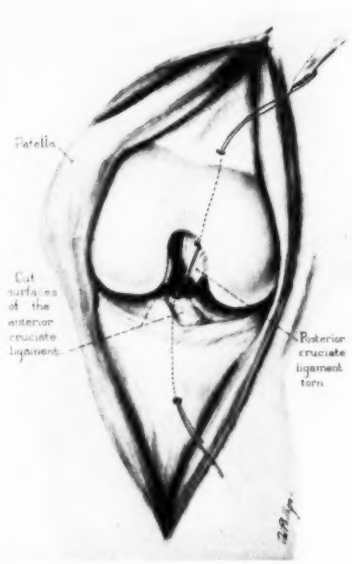


Fig. 4.

Fig. 5.

Fig. 3. The anterior crucial sutured into position.
Fig. 4. Shows drill holes for the insertion of the posterior crucial. In this case, the drill hole through the femur should emerge at a point somewhat posterior to the opening as shown in the picture.
Fig. 5. Posterior ligament sutured into position.

not particularly important, since we must depend upon the formation of bone around the piece of fascia to secure the proper firmness.

A similar procedure can be used for repairing the posterior crucial ligament. The entrance of the drill into the femur and into the tibia may be at exactly the same point as would be used in the repair of the anterior crucial, or it may be shifted to one side or the other, which side is not important (Figure 4). The drill hole in the tibia goes upward and backward and emerges in the center line of the tibia, approximately one-quarter of an inch from the posterior margin (Figure 4). It is important that this opening be as far to the back as it is possible to put it. The drill hole in the femur goes downward and forward, and emerges on the inner side of the intercondyloid notch, at the point where the posterior crucial has its normal femoral insertion (Figure 4). A piece of fascia, 6 inches long by three-quarters of an inch wide is now rolled and pulled through the holes in the tibia and femur, exactly as in the case of the anterior crucial, and the fascia is secured in exactly the same manner (Figs. 4 and 5).

The following points should be mentioned in favor of this operation.

1. It is a very easy matter to get the required amount of exposure.
2. The insertion of the ligament corresponds exactly to the normal insertion of the ligaments.
3. The long transverse incision, used heretofore, is avoided.
4. The material used is certainly as strong as the normal crucial ligament. The articular surfaces of the joints are not in any way disturbed.
5. Finally, it does not require such a high degree of skill as is required in either the Hey Groves or Putti operation and it is far more accurate.

It is my belief that this operation is far better than anything heretofore described, but it is far from being perfect. We can never hope, however, that any operative procedure will imitate the close relationship that exists between the two crucials, as well as between the crucials and the various other joint structures, such as the infrapatellar fat pad, the internal and external semilunar cartilages, and the synovial membrane.

HERNIA THROUGH THE FORAMEN OF WINSLOW

The Report of a Case with Reference to Thirty-Three Other Cases Collected from the Literature

By JOHN W. DEWIS, A.M., M.D., and RICHARD H. MILLER, M.D., F.A.C.S., Boston

HERNIA of small or large bowel from the greater into the lesser peritoneal cavity through the foramen of Winslow is rare, and there are fewer instances of this than of any other form of internal concealed hernia. The condition is interesting not only on account of this rarity, but also because of its anatomy, pathology, symptomatology, diagnosis, and treatment. For this reason, we report in detail the case which forms the basis of this paper. We have found reference to only 33 cases in the literature.

Jeanbrau and Riche (14) in 1906 collected 18 cases; Ullman (32) brought this up to 30, in 1924; Delagenière (7) in the same year considered the subject fully and added 1 case of his own, making 31. One case reported by Corry (6) is not included in these lists, nor is another described by Copenhaver (5). We can, therefore, bring the present number reported up to 33, and, adding our own, make a total of 34. The first 30 of these are reviewed in some detail by Ullman, and it seems more feasible to refer the reader to his excellent article (32) than to enumerate these cases here. Brief reference, will, however, be made to those not recorded by him, and the other cases will be cited when they are relevant to the phases of the subject as they arise in this paper.

THE ANATOMY, PATHOLOGY, AND ETIOLOGY

The foramen of Winslow lies just below and behind the portal fissure of the liver. It can easily be reached by running the finger along the gall bladder and cystic duct behind the free edge of the lesser omentum. Its boundaries are: behind, the vena cava, covered with peritoneum; above, the caudate lobe of the liver; below, the hepatic artery and the first portion of the duodenum; and anteriorly, the free border containing the common duct, portal vein, and hepatic artery. Thus it is seen that the structures composing its walls are of vital importance, and surgical modification of its dimensions is fraught with danger. The only actual surgical measures ever designed have been proposed by Jeanbrau and Riche (14), and will be referred to later. The foramen is only a potential canal, its walls normally lying in contact. It easily admits the forefinger, or at times, two fingers. With a foramen of normal size, and the intestines and mesenteries normal, a hernia through this opening should not occur, and it is fair to assume, with Copenhaver (5), that one of the following anomalies must be present: (1) common mesentery for the whole intestinal canal; (2) absence of secondary fusion of cæcum to the posterior abdominal wall; (3) abnormally large foramen, or (4) abnormally long mesentery with undue mobility of the intestine.

Violent muscular exertion, with straining, has been assigned as an immediate cause in many of the cases; and in this connection, the large majority of them have been in men. It seems to us, however, that this is only a casual relationship—that it is rather a case of *post hoc, ergo propter hoc*. But, if a loop of intestine is lying right at the mouth of the foramen, we think it possible that at such a time any violent spasm of the abdominal muscles might force the bowel into the lesser peritoneal cavity.

Brief histories of the cases not hitherto reported follow.

Case No. 32, Corry (6). A Hindu woman, aged 30, who had been sick for 5 days, was seen with the usual symptoms of intestinal obstruction. The whole abdomen was distended, but swelling was especially marked in the epigastrium and around the umbilicus. At operation, three feet of small intestine were found herniated through the foramen of Winslow. This was pulled out by traction, and the patient recovered.

Case No. 33, Copenhaver (5). The patient was a woman of 56 with symptoms of acute intestinal obstruction. At operation it was found that the cæcum and ascending colon had herniated through the foramen of Winslow and had then perforated through the anterior layer of the lesser omentum and lay in front of the stomach. After the bowel had been emptied through a needle, the hernia was reduced, and a catheter inserted in the bowel. There was marked relief of symptoms, at first, but the patient died shortly after and autopsy revealed a volvulus of the large bowel which had been released from the hernia.

Author's case. A woman of 42 was seen on August 9, 1924; 20 days before this (on July 20), while doing her housework, she was seized with epigastric pain. This was soon relieved by vomiting—the character of the vomitus was not observed. She was then free of all symptoms for two weeks, when, on August 4, she was again taken with an attack of epigastric pain. Before either of these attacks, she had done no work requiring muscular exertion, and there had been no straining at stool. The pain was so severe that 3 hours after its onset morphine and atropine were required to obtain relief. During the night the pain returned and again necessitated the administration of morphine. It was most marked in the right upper quadrant,

Fig. 1. Hernia through foramen of Winslow. A schematic representation of the hernia as observed in reported cases.

radiated downward, and was somewhat relieved by enemas. By morning, the pain recurred and continued during the day. Enemas gave no relief now and there was no passage of fæces. The next day, August 7, the condition had not changed. There was no vomiting. Enemas were still given. Later in the day, the temperature rose to 102.4 degrees F. The pain also increased, and there was tenderness in the right upper quadrant of the abdomen. On August 8 there was a "normal bowel movement." Also, *she vomited* (again, appearance of the vomitus not noted). After vomiting, there was relief from pain—the first spontaneous relief in 4 days. On August 9, the symptoms had grown worse. There was great epigastric distress and pain, "fever and chills," and thirst. This pain extended through to the back, and the patient got some relief from it by taking the knee-chest position.

Physical examination. (3 p.m.) A small, spare woman, lying in bed; weary and restless; temperature 99.8, pulse 84, respiration 18. The eyes were sunken; the pupils equal; breath offensive; tongue dry; sordes on teeth; no enlarged glands; heart, lungs, and patellar reflexes were normal. There was no œdema anywhere.

Abdomen. Upper portion full, especially over epigastrium and to right. Tenderness from ensiform to umbilicus, and in gall-bladder region; in the tense epigastrium, there was a vague, indefinite mass, dull to percussion; the rest of the abdomen was mostly tympanitic. The cæcum and ascending colon seemed filled with fæcal matter. Appendix scar was present. The muscles on the left side of the abdomen were lax and the sigmoid was contracted and hard. Rectal and vaginal examinations were not done.

Blood. Hæmoglobin 80 per cent, white count 15,800. Smear showed nothing remarkable. Wassermann negative.

The patient was sent to a hospital, and as she then seemed better, it was decided to try improving her condition still further before operating. Many diagnoses were considered, but the most probable was thought to be partial perforation of a peptic ulcer, or acute cholecystitis. An enema resulted in the passage of some fæces and gas. The next morning her condition was improved, but during the day the symptoms again became aggravated and operation seemed imperative.

Operation, August 10. Anæsthetic, ether. A stomach tube was passed, and about a quart of green-black fluid of pea-soup consistency and of fæcal odor was siphoned out. Six-inch median epigastric incision. The stomach was small and injected. Pushing up behind the stomach, and most prominent behind the gastrohepatic omentum, was a firm, tense tumor, the size of a grapefruit, which felt cystic. A rapid glance at the neighboring organs revealed nothing abnormal. The entrance of intestine into the foramen of Winslow was not observed. Incision was made through the gastrohepatic omentum, and there was exposed a smooth, purple-black tumor. On opening this, there was a gush of about a pint of brown fluid of fæcal odor. Two soft rubber tubes were sewed into the opening of the tumor sac for drainage. Further exploration was impossible, and the abdomen was closed without the true situation having been demonstrated. A small piece of tissue of the sac wall was removed and, later, examined microscopically and reported to be gangrenous intestine by Dr. J. H. Wright.

The immediate postoperative recovery was gratifying: the pain was relieved, the patient's condition improved, and she soon began to take restricted diet.

Shortly, it became apparent that there was a fistula into the small intestine, resulting in a constant and profuse discharge of liquid contents with particles of food from the small bowel. Every attempt was made to build up the patient's condition in order to make possible a second operation, but without avail. The temperature was never high; the respirations averaged about 20; but the pulse was always rapid and of poor quality. She gradually sank and died 31 days after operation.

Postmortem. This was only partial, and done under some difficulty after the body had been embalmed. A long incision was made from the pubes to the ensiform to the left of the middle line. The stomach, transverse colon, and great omentum were identified and pulled up; these were essentially normal. The junction of the duodenum and jejunum was easily found. The jejunum was followed up and, after a very short distance, was found to turn upward and disappear in the foramen of Winslow. The distance from the beginning to the point of disappearance was 120 centimeters. Coming out of the foramen of Winslow was another loop of collapsed small intestine which was followed down and, at a distance of 90 centimeters, was found to join the cæcum. This meant that all of the small intestine except the 120 centimeters of the jejunum and the last 90 centimeters of the ileum had been contained in the hernia. The lesser omental cavity was then broken into above the stomach and found to contain a mass of necrotic fowl tissue, part of which was evidently bowel wall. The right side of the abdominal wall, extending downward from the operation wound, was undermined between the peritoneum and the muscle by infection, making a large cavity. The liver appeared normal, and nothing remarkable was observed in the pelvis. No organs were removed. (We marveled that the patient had lived so long with only a little over a meter of the jejunum left as an avenue of

fluid and nourishment to the body. Furthermore, it seemed that, had it not been for the exhaustion from the large septic cavity, the patient might have lived longer and even improved sufficiently to warrant a second operation. Still, had this been possible, probably the only procedure would have been to do an anastomosis between the loops of the small intestine proximal and distal to the hernia. Likely, with so little bowel left, the outcome in a short time would have been the same.)

Past history. (The family history was not important, and the past history is purposely placed here after the present illness.) There were no acute diseases in childhood, and no history of sore throats, rheumatism or chorea. She had had grippe twice 17 years ago, had always been nervous; and 18 years ago had had a "nervous breakdown." Two children were living and well, aged 10 and 15 years. Preceding these, was one of premature birth. Menstruation was not abnormal. In 1914, an abdominal operation had been performed, said to have been appendectomy, right salpingo-oophorectomy, and ventral suspension. Habits: Ate slowly; tea and coffee rarely; no alcohol; constipated, used senna and figs.

When a young woman, the patient began to have periods, after meals, of uncomfortable feeling in the stomach. These reappeared without apparent reason, sometimes after a remission of many months. As time went on, the attacks became more distressing, were of longer duration, and accompanied by soreness in the upper abdomen. There was no nausea and no vomiting. She learned at these times that liquid food gave least distress, and often for weeks she could eat no solid food. In the fall of 1917, she consulted Dr. E. B. Freeman of Baltimore, had an examination by X-ray, and was treated in St. Agnes' Hospital where she was kept in bed 3 weeks and was given a careful diet. Since then, the old symptoms continued, with increasing frequency, to recur, but had no relation, as far as the patient could observe, to diet, exertion, or physical tire. Late this spring, while taking a liquid diet for this stomach trouble, she lost 20 pounds in weight, her usual weight being 112 pounds. Afterward, while eating solid food, after the stomach trouble had gone, she gradually gained 6 pounds, had a good appetite, and was comfortable until the present attack.

Dr. Freeman has allowed us to use here the valuable notes from the record of the patient, obtained by him on October 25, 1917:

"*Present illness.* Digestive symptoms began 10 years ago with fullness and pressure in the upper abdomen. These symptoms would occur periodically, and usually last a few days to a few weeks, not to return again for several months. In the past 6 months, the fullness and pressure have been constant, and the patient has noticed a great deal of abdominal soreness. There are, however, no severe attacks of pain, no nausea or vomiting. Appetite is always good. Bowels are habitually constipated. Present weight 110 pounds; former weight 115 pounds.

"*Physical examination* shows a rather small woman, anæmic in appearance. Pupils are active and equal. Extra-ocular movements are normal. No exophthalmos. No tenderness over accessory sinuses. No discharge from ears. No general glandular enlargement. Isthmus of thyroid palpable. Teeth are in good condition; a number have been filled. Throat normal in appearance. Lungs apparently clear throughout to auscultation and percussion. Heart normal in size. Sounds clear at base and apex. Blood pressure, 120/70. Pulse, between 50 and 60. Abdominal examination: wide costal angle; soft abdominal muscles. Definite cæcal stasis without tenderness. Sigmoid is easily felt and is spastic. Right kidney freely movable. Liver, spleen, and left kidney are not palpable. Deep reflexes are normal.

"*Stomach analysis.* Fasting stomach. Empty after the usual rice retention meal. Test breakfast; 25 cubic centimeters free hydrochloric acid 20 degrees; total acidity 50 degrees.

"*Fluoroscopic examination* (10-27-17). Stomach is two finger breadths below the crest, in good position. Normal peristalsis and motility. Stomach and cap normal in outline. There is definite cæcal stasis. *First portion of the transverse colon is up and toward the left, in the prepyloric region.* (Our italics.) At this point, the transverse colon dips down into the true pelvis. Splenic flexure in good position. Impression: Second degree splanchnoptosis with adhesions in the right upper quadrant of the abdomen."

Our patient's clinical history, compared with the records of similar cases, is exceptional because none of the 33 cases previously published gives an account of symptoms extending over so long a time, and the case has been of particular interest to us because, in a period of 17 years or more, there has been a repetition of attacks of fullness and pressure in the upper abdomen lasting for days or weeks, with remission of symptoms for months. This was indication, we believe, of spontaneous reduction and recurrent formation of a hernia through the foramen of Winslow without symptoms of intestinal obstruction. The X-ray examination made by Dr. Freeman, 7 years before, showed that the first portion of the transverse colon was pushed or held up in the prepyloric region, and, in view of all the data now obtained in the case, we think this is some evidence of, at least consistent with, the presence of a hernia in the foramen of Winslow at that time.

There are other instances of these hernias existing without intestinal obstruction and, likewise of their spontaneous reduction.

We learn from Neve's (19) report that spontaneous reduction of a hernia through the foramen of Winslow may happen, for, even though he was unable to remove much of the gut from the hiatus at the time of the laparotomy, later, recovery took place—the first to occur following laparotomy. (We presume that, later, the reduction of the hernia was completed, because it was stated there was "recovery"—unless the hernia persisted without symptoms.) Also, in Neve's case, there was only partial intestinal obstruction. That there may be no evidence of obstruction in these hernias is set forth in Picado's (20) case in which there was only epigastric swelling—which the mother attributed to sudden accumulation of fat—for 12 days before the breaking-out of "alarming symptoms." The only complaints during this period were discomfort, weight, and "lazy digestion." Then, again, the first case recorded—that of Blandin (3) in 1824—was one in which no obstruction of the bowel was found in the hernia through the foramen of Winslow. Only

when the herniated bowel had formed a second hernia was there strangulation at the point of rupture in the transverse mesocolon where it had forced its way from the small into the large abdominal cavity. A double hernia was what took place in Treves' (31) patient, the first recorded operation on a patient with a hernia through the foramen of Winslow, but in this instance there was obstruction of the bowel at the foramen of Winslow, and, with this further difference, that the second hernia was formed by the cæcum and appendix which forced a way out of the lesser peritoneal cavity through the gastrohepatic omentum and lay on the anterior surface of the stomach. This was like the case of Copenhaver (5), already stated. A second hernia had almost formed in our patient—a tense cystic tumor behind the stomach was bulging up and about to push through the gastrohepatic omentum.

SYMPTOMS

The symptoms, in the absence of definite intestinal obstruction, are epigastric discomfort, weight, swelling, fullness, and pressure; and fullness and pressure were the frequently recurring complaints in the long history of our patient. Likewise, in Picado's (20) patient, there was "swelling" for 12 days before "alarming symptoms appeared." So, if we could establish a diagnosis of hernia through the foramen of Winslow, the absence of pain would indicate that there was no definite obstruction. This group of symptoms, at least some of them, are also coexistent with the pain in obstruction, and it was so with our patient.

Pain is always present with hernia through the foramen of Winslow when accompanied by intestinal obstruction. The pain is usually located in the epigastrium or right upper quadrant, or, in both areas, as exemplified in our case. Again, the abdominal pain may be quite general as stated in Ullman's (32) case, in which 4 inches of the lower ileum formed the hernia. Morton (18) found the pain in the central and lower abdomen, and the lower ileum was herniated; while Majoli (15) reports the pain was in the "lumbar" and abdominal regions, the transverse colon making the hernia. In the remarkable account by Radovan (21), the "torturing pain" was situated in the right iliac fossa, and the great mass of bowel found at operation in the lesser peritoneal sac consisted of a large portion of the transverse and all of the ascending colon, cæcum, appendix, and part of the ileum which had gone through the foramen of Winslow. This patient recovered! Further, the pain may be intermittent, paroxysmal, or almost constant. The writers think, after studying all the literature, that the location of the pain helps little in determining the portion of the bowel in the hernia, but that pain does suggest intestinal obstruction; and we know, too, that if the hernia causes pulling or tension on the mesentery, it would produce pain.

Vomiting, often projectile in character, is the most constant symptom after pain, but it seems not to occur, as a result of these hernias, where there is no intestinal obstruction. Our history shows no vomiting until it occurred with an acute attack of epigastric pain, followed by disappearance of all symptoms for 2 weeks. The writers are convinced these hernias may disappear and recur, and conjecture that, in this instance, the act of vomiting caused a temporary reduction of the herniated bowel. But when, thereafter, vomiting presented itself, and pain and distress would disappear for hours, the relief was probably dependent upon removal of distention from the stomach and jejunum. Treves (31), however, states that vomiting gave his patient no relief. Vomiting is frequently mentioned in the histories—by Elliot Square (29), Picado (20), R. Stecchi (30), Morton (18), and others. The appearance and odor of the vomitus, however, are seldom mentioned; and this sparsity of detail in various other ways relating to the patient and the symptoms leaves an incomplete picture in the majority of the histories. Such an omission, as not to state the character of the vomitus, however, may be unavoidable, since all physicians know how often patients or the attendants are unable to describe its color, odor, quantity, or consistency.

Therefore we are able in these respects to sift little data of value from the histories before us.

Carwardine (4) says that his patient, an engineer, aged 44, while telephoning was seized with a severe colic which doubled him up, and while he was not at first "sick," had slight nausea, later was "sick" several times, and, two days from onset, brought to the Infirmary black vomitus, "black as ink," and it was wondered if he had not swallowed ink. He was operated upon at once, and the herniated bowel was found to be black and lustreless, as in our case. As stated in our report, a quart of green-black fluid was removed from the patient's stomach just before operation. It was fæcal in odor and as thick as the usual pea soup. In Carwardine's (4) history was the first mention we found of any of the characteristics of the vomitus. After intestinal obstruction has taken place, we suppose it is not known when the vomitus first becomes "fœtid" or fæcal, and the time might so vary in different cases that it would have little value as diagnostic data. Fæcal vomitus is always

proof of obstruction. Majoli (15) says that his patient—a man 44 years old—first suffered profuse sweating, and that this was followed in half an hour by sharp abdominal pains, which were relieved by eructation of "fœtid" gas. We all know that vomiting brings ease to a distended stomach, and we have noted that vomiting often relieves pain in obstruction of the intestine, doubtless because the tension of the bowel has been removed by regurgitation of its contents into the stomach. In our patient, after vomiting there was rest from severe pain and other symptoms for 2 weeks before her last attack. Vomiting, in this instance, may have temporarily reduced the hernia. In the final attack of our patient, there was always a period of relief after vomiting.

We assume that the "profuse sweating," stated to have occurred in Majoli's patient a half hour before the appearance of pain, was in great part a shock symptom resulting from the drag on the mesentery, though this should ordinarily have caused pain.

Constipation is often mentioned in connection with hernias through the foramen of Winslow. In Elliot Square's (29) patient there was no action of the bowels for 4 days after the onset of the symptoms. Failure to obtain benefit from enemas or cathartics is often stated. Purgatives, when administered, seemed always to increase the pain and other symptoms—and there could be no other effect! Besides, we know that repeated cleansing enemata may not remove all fæcal masses from the upper part of the large bowel, which may remain there for many days. Only recently we observed this in a case of acute obstruction of the lower ileum in which the cæcum and ascending colon remained filled with large inspissated masses of fæces—unusually dry because there had been much vomiting and, as a result of dehydration of the tissues, the system had drawn eagerly upon all available fluid in the body. Repeated enemas had returned without fæces, yet when the obstructive band was cut during an operation, gas and fluid were pressed easily into the colon and around these masses. So, we think that in this affection, and intestinal obstruction generally, the knowledge whether the bowels move or do not would contribute little to the diagnosis, because the bowel below the obstruction may not be emptied of fæcal matter for days after intestinal stoppage when the patient might pass fæces. Our patient had "what seemed like a natural bowel movement," accompanied by vomiting, 4 days after the beginning of the last acute attack, and she was then fairly comfortable for 12 hours. Such an occurrence is perplexing when we are thinking of acute intestinal obstruction, and we must remember to discount the negative evidence of bowel movements.

Posture is sometimes mentioned in the records. At the onset of an attack of pain, our patient would often take the knee-chest position, which she thought made the pain less intolerable; at other times she lay on her back, with the legs flexed, though sometimes extended. Majoli's patient had less pain in the sitting posture; Elliot Square's patient was doubled up with the pain, or when easier, sat up by the fire; while Treves' patient insisted on getting up, walking down stairs, and remained in a sitting posture because he could not lie down.

The facies of the patient is seldom mentioned: Majoli observes that the eyes are cloudy and sunken and the skin yellow; and Ullman says the patient's eyes were sunken and the "face pinched and haggard, skin clammy, very toxic"; Jeanbrau and Riche speak of the facies as "drawn"; our patient looked weary, had sunken eyes, and a dry, brown-coated tongue—one of the evidences of the dry tissues—and she complained of thirst; and Picado also mentions a dry, coated tongue, and thirst.

Distention, fullness, or swelling of the epigastrium or upper abdomen is generally noted, if an examination is made. Our patient, when seen on the fifth day of acute symptoms, exhibited epigastric fullness and tension extending toward the right; and this area felt tense. Tenseness and resistance is the description of Carwardine and Engstadt, while Ullman adds "marked resistance." Reynier, as quoted by Jeanbrau and Riche, seemed much impressed with the flattening of iliac fossæ in contrast with the prominence in the epigastric and hypogastric regions, and the latter authors make a similar observation. We think this appearance of the abdomen, when present, would be a valuable diagnostic sign of hernias through the foramen of Winslow.

We noticed a spherical mass in the epigastrium; and after emptying the stomach by the stomach tube, we could feel a very definite tumor of a grapefruit size, and the percussion note over it was dull both before and after this procedure. Treves' patient presented dullness for the first time on the seventh day. In Corry's case, the entire abdomen was tympanitic. In this respect, the findings vary, depending, of course, upon the fullness or emptiness of the stomach, and whether it contains air or gas; and we suppose, also, that the tumor sac may sometimes contain gas. The occurrence of an epigastric tumor in these hernias is probably usual. A tumor was observed by

Majoli, Picado, Jeanbrau and Riche, Sinclair, Radovan, and Engstadt.

Epigastric or upper abdominal tenderness is doubtless always present, though it may be hardly evident, even though there be marked muscular resistance, as we note in Ullman's case. We found tenderness over both the epigastric and gall-bladder regions. Copenhaver detected tenderness only over the gall-bladder area, while Morton found the abdomen only slightly tender just to the right and below the umbilicus.

The temperature, pulse, and respiration are not generally recorded in the literature, but, in our patient, these seemed not affected in proportion to the extent of the condition found within the abdomen. Up to the time of the operation, the respiration and pulse—except during a paroxysm of pain—varied little from normal, and there was little departure from normal in the temperature. These facts, taken with the generally fair condition of the patient, appeared incompatible with the finding of a large mass of necrotic bowel on opening the abdomen; and it caused us great surprise. We recall that most patients present the appearance of being very sick following acute obstruction of the bowel, as from twists and bands. Perhaps the obstruction developed slowly here, and in some way may have allowed the system to adjust itself to the influx of poison. In Elliot-Square's patient, there was a rapid pulse and high temperature; in Engstadt's, *the pulse was 36, the heart beats 90*, and temperature 103; in Picado's a labored respiration, fever, and faint pulse; and in Jeanbrau and Riche's there was apyrexia. There was no uniformity found, probably because of the varying complexities in the different patients.

No intestinal peristalsis was observed in our patient before operation, but after this, while the dressings were being changed, peristaltic waves were sometimes seen over the left middle abdomen, followed in a few moments by expulsion of contents from the abdominal opening leading to the herniated sac. Also, in the records of these hernias, we noticed only three references to intestinal peristalsis, and these to the effect that it was absent. Morton says there was intestinal splashing, but no distended coils seen, and Ullman and Copenhaver found no evidence of peristalsis. We think this absence of waves may be due often to the amount of intestines drawn into the lesser abdominal sac.

Blood. In our patient the hæmoglobin was 80 per cent and the white count 15,800. In Ullman's patient, with about the same duration of symptoms, the white count was 16,400.

The literature gives no information bearing on a direct cause of hernias through the foramen of Winslow: Treves' patient was seized with epigastric pain 3 hours after a heavy meal; in Delkeskamp's patient, the epigastric pain developed immediately after normal labor; in Morton's case, pain came after defæcation; in Sinclair's after a spell of coughing; in Engstadt's patient, after lifting a heavy weight; in Carwardine's, the pain came on while the patient was telephoning. In our patient, no such incident was obtained from the history, and this agrees with a number of the histories given, though *it should be especially noted that the pain, almost always epigastric, usually occurs suddenly.*

We believe that a correct pre-operative diagnosis of hernia through the foramen of Winslow can be made. We think that we could be able to diagnose another case. The general opinion is that if we recognize intestinal obstruction it is the essential point. We should, of course, be able to do more than that. Surely, it is helpful for the surgeon to have a fairly clear idea of what he is to treat when he enters the abdomen. In approaching a diagnosis of acute cases, we give what we consider the important symptoms in their order: (1) acute epigastric pain; (2) tumefaction or definite tumor in this region; (3) obstipation; (4) repeated attacks of vomiting with temporary relief, and the usual general symptoms of intestinal obstruction. The previous history would rarely help, as ours is the first published case suggesting recurrent attacks.

TREATMENT

The *sine qua non* is, of course, the early recognition of the fact that a surgical emergency is present, even though it be impossible to make a correct diagnosis.

In the cases recorded in the literature, the operative procedure has been as follows:

1. Reduction by simple traction. This was accomplished very easily in 1 case, easily in 4, with some difficulty in 1, and was found to be impossible in the others. Traction may always be tried, but it should be borne in mind that the pull must be very gentle, and it may be assisted by pressure over the herniated bowel above the stomach.

2. Reduction by traction after finger dilatation of the foramen of Winslow. This was accomplished in 2 cases, but is seldom possible.

3. Reduction by pressure from above, and taxis, after evacuation of the herniated bowel through a trocar. In 2 cases this method sufficed to restore the bowel to the greater peritoneal cavity.

The fact that reduction was possible in the above cases does not, however, mean that the patients all lived, because the mortality was very high.

Enlargement of the foramen of Winslow may be undertaken only with the greatest care, because of the danger of injury to the common duct, hepatic artery, portal vein, and vena cava. The following method of *débridement* of the foramen suggested by Jeanbrau and Riche is translated from their article (14).

"An incision is made on the first portion of the duodenum, parallel to it, through the peritoneum which forms the anterior layer of the lesser omentum. After this it is possible to push down the first portion of the duodenum, while the peritoneal leaf is lifted upward, exposing the vessels, and one then sees a space between the common duct and the portal vein, the bottom of which is formed by the posterior peritoneal layer of the lesser omentum, which extends backward to be reflected off the vena cava. Then, holding the common duct out of the way with the thumb and index finger, and protecting the vena cava with this finger, the operator makes a hole in the posterior layer of the lesser omentum close to the duct and between it and the portal vein; thus a vertical buttonhole is formed, parallel to the duct, and large enough to admit the finger. By gentle traction, the left border of this buttonhole, containing the hepatic artery and portal vein, is drawn to the left. Then the operator, with the left index finger still in the foramen, protecting the vena cava, inserts the right index finger into the buttonhole already made. Working his finger along toward the back, he easily enlarges the buttonhole, also breaking through the floor of the foramen, thanks to the laxity of the tissues behind the duodenum. Then light traction suffices to draw out the herniated bowel—at least if there are no adhesions; and there usually are none." They say further: "We have done this several times on the cadaver. In each case, we were able to determine that a foramen, which would normally admit only the index finger, would, after débridement, admit two or even three fingers." For a more detailed account of the procedure, reference should be made to their article.

The general principles of treatment would be obvious at once to any surgeon, and can be summarized briefly as follows:

1. This is a surgical emergency and early diagnosis must be made. 2. Immediate exploration is preceded by gastric lavage. 3. Gentle traction is assisted by gentle pressure from above. 4. If this fails, the distended loops are evacuated by means of a trocar, the opening in the bowel closed, and traction is tried again. 5. If reduction is still impossible, a temporary ileostomy or jejunostomy may be made in one of the herniated loops, with the hope of tiding the patient over the crisis, and of being able to do more at a later date. Also, a lateral anastomosis between loops above and below the obstruction should be considered. The procedure must be adjusted to the individual case. 6. Débridement of the foramen of Winslow may also be considered.

This case of hernia through the foramen of Winslow is presented especially for these reasons: because it is a rare condition; that it is the second case to prove that these hernias may form without acute symptoms (Picado's case was the first); because it suggests, as indicated by our patient's history, that such hernias may be reduced spontaneously and recur many times; and for the reason that it adds proof to other case reports that a hernia through this opening may exist without obstruction of the bowel.

We should not forget this condition when considering affections of the upper abdomen, and should remember that the first signs of its presence are sudden swelling or protuberance of the epigastrium coincident with the onset of the symptoms of pain and distress. It is important, finally, that the surgeon, when exploring the upper abdomen for an obscure surgical lesion, should include the examination of the foramen of Winslow.

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A TECHNIQUE FOR THE REPAIR OF LARGE VESICOVAGINAL FISTULÆ[1]

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VERY little has been added to the principles of the operation designed by Marion Sims in 1852 for vesicovaginal fistulæ. In most instances Sims' principles, with Emmet's technique, suffice for the fistula about 2 centimeters or less in diameter. Before vaginal and total abdominal hysterectomies were practiced as extensively as they are at present, the average vesicovaginal fistula measured about 1 to 1½ centimeters in diameter and was generally caused by prolonged labor. Surgical procedures through the vault of the vagina, such as total hysterectomies, are occasionally followed by vesicovaginal fistulæ, from 1 to 4 centimeters in diameter.

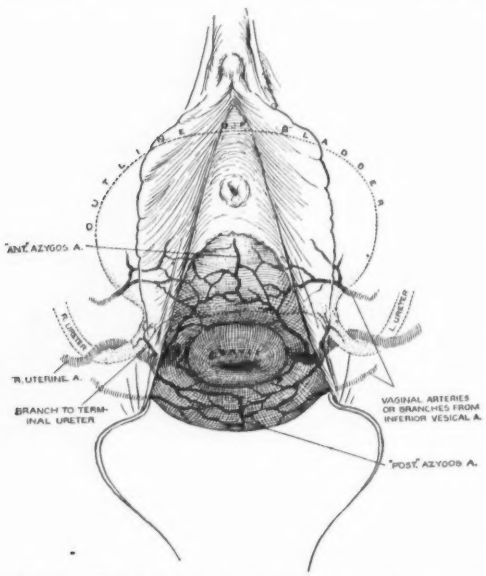

Fig. 1. Blood supply of the vaginal vault, apposed bladder and terminal ureters. The usual variation of arterial distribution can occur here leaving this area more scantily supplied than the composite drawing depicted here.

These fistulæ are due either to a direct injury of the bladder wall or to an interference with the blood supply of this particular area in the bladder. It is not uncommon to note that leakage of urine through the vagina does not occur until 4 to 10 days have passed following a total hysterectomy. This naturally suggests that necrosis of a limited area of the vaginal and bladder walls occurred, finally allowing a flow of urine into the vagina.

The interference with the blood supply of the lower ureter and bladder following total hysterectomies, as a cause of postoperative ureteral and bladder fistulæ, is a point deserving of more consideration than it has received in the past. The blood supply of the inner portion of the anterior vaginal wall, and the apposed bladder, comes from branches which originate from the inferior vesical and uterine arteries. The uterine arteries send branches to surround the vault of the vagina, the anterior branches uniting to form a single vessel which runs forward in the midline of the anterior vaginal wall. This is known as the arteria azygos vaginæ. It receives a few branches from the inferior vesicles. Figure 1 clearly shows that a total hysterectomy may block the blood supply to the anterior vaginal and apposed bladder walls. This same operation may also block the blood supply to the lower ureters, which comes from the uterine artery. In one instance, during a total abdominal hysterectomy, with both ureters carefully exposed to avoid their injury, a ureteral fistula developed 5

[1] Read before a meeting of the Nebraska Section of the American College of Surgeons at Grand Island, November 12, 1926.

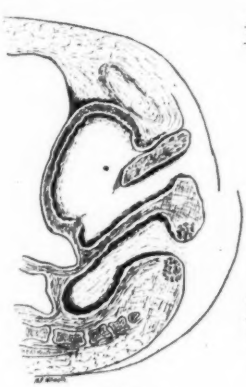

Fig. 2.

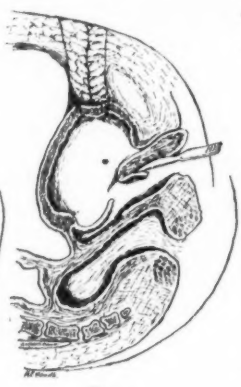

Fig. 3.

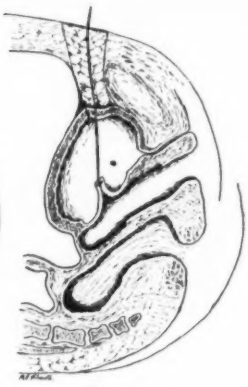

Fig. 4.

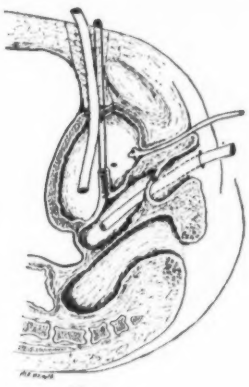

Fig. 5.

Fig. 2. Large vesicovaginal fistula. The illustration does not show the broad ligaments adhered to the bladder following total hysterectomy.

Fig. 3. The bladder has been opened suprapubically and the vaginal walls surrounding the fistula have been dissected free from underlying structures.

Fig. 4. The first stitch uniting the vaginal walls is used as a traction suture, being drawn through the suprapubic opening. A portion of the vaginal mucosa has now become bladder mucosa.

Fig. 5. The vaginal flaps have been further sutured and drawn upward by the first suture, which is finally fastened under moderated tension to a glass rod lying across the suprapubic wound. The edges of the remaining vaginal walls are sutured together and a rubber drain is placed into the dissected area and brought to the surface outside the vaginal wall. The suprapubic drainage tube and retention catheter are inserted to prevent urine from accumulating in the bladder and to prevent the possible leakage of urine through the vagina.

days after the operation. I feel positive that this fistula came from shutting off the blood supply. This can also happen during vaginal hysterectomies.

I have had referred to me by surgeons who had previously performed vaginal hysterectomies under considerable difficulties 2 cases of large fistulæ of the bladder. These fistulæ were about 4 or 5 centimeters in diameter, and were located just posterior to the trigone, possibly taking in the posterior portion of it. So much bladder tissue was destroyed that it would have been impossible for me, through the vagina, to have approximated the edges without tension even after an extensive dissection. In the first instance, I attempted a dissection in order to liberate the bladder, but without success. I repaired these fistulæ with the following technique so successfully that I am prompted to make this report.

An incision in the vaginal walls is carried through their entire thickness, starting an inch or more away from the fistula. The vaginal walls are then dissected up to within a quarter of the margin of the fistula. Thick flaps are necessary for an ample blood supply. These flaps are united in several layers with chromic catgut, the first suture being pulled through the previously performed suprapubic cystostomy and kept under slight tension to assist in coaptation of the vaginal flaps. The bladder should be left open above for drainage, and a self-retaining catheter placed in the urethra. In the area remaining after the vaginal flaps have been turned into the bladder, a drainage tube is placed and brought to the surface paravaginally. This is done to prevent a possible leakage of urine through the vagina and the re-establishment of the vesicovaginal fistula.

The aftercare is extremely important. The urethral catheter should be irrigated twice daily, the irrigation being allowed to come through the suprapubic tube or wound. The drain inserted paravaginally should be left in at least 10 days in order to drain urine which may possibly leak through the flaps in the bladder.

The history of the operation for vesicovaginal fistula up to 1912 has been very interestingly written by Howard A. Kelly.[1] C. H. Mayo[2] describes an operation quite similar for the small vesicovaginal fistula. The vaginal flap, which he inverts into the bladder, is used for traction only to assist in coapting the outside bladder walls for suturing. The operation I am describing differs from Dr. Mayo's in that the vaginal walls are reflected to become bladder walls. Traction on

[1] Tr. Am. Gynec. Soc., 1912.
[2] Ann. Surg., 1916, lxiii, 106.

the larger vaginal flaps does tend to coapt the bladder walls, but the flaps cannot be brought together as in the operation for the small vesicovaginal fistulæ.

CASE REPORTS

CASE 1. The patient, age 47, had given birth to 3 children. Vaginal hysterectomy had been performed by another surgeon for prolapse of a subinvoluted uterus. Five days following the operation, urine was noticed coming through the vagina. For the first 4 days following the operation, the bladder apparently held all the urine secreted by the kidneys. Ten days after the operation, the vagina was examined and a large vesicovaginal fistula was found. After consultation, I advised waiting a month in order that better circulation might be established in the tissues around the fistula.

Two months from the time of operation I repaired the fistula by reflecting the vaginal flaps into the bladder. This operation was performed 8 years ago and the patient has remained perfectly well.

CASE 2. The patient, 50 years of age, had given birth to 4 children and had had 2 miscarriages. In March, 1926, a vaginal hysterectomy had been performed elsewhere by a surgeon of marked ability. The bladder, after the operation, apparently held all of the urine, and no signs of a vesicovaginal fistula appeared until the seventh postoperative day.

I attempted a repair of this fistula, which was about 5 centimeters in diameter, 2 weeks after the operation and met with a complete failure. I attempted a mobilization of the bladder and vaginal walls, which could not be accomplished sufficiently for closing this large opening.

Two months after the hysterectomy, I opened the abdomen and closed the fistula, operating through the peritoneal cavity. The results were apparently perfect for about 1 month, when the upper anterior wall of the vagina and the apposed portion of the bladder seemed to slough away with a recurrence of the fistula.

After waiting 4 weeks for an increase in circulation in the tissues surrounding the fistula, I repaired the fistula by the technique illustrated. For about 10 days the results were good. The patient then complained of a sudden severe pain beneath the sternum and in the lumbar region. The heart action rapidly increased and death occurred 36 hours after onset of pain. An autopsy by an experienced pathologist disclosed nothing but chronic nephritis and chronic hepatitis. The bladder was so very firmly united in the previous area of repair that it appeared, without doubt, that the results from the operation would have been permanent.

LOCAL ANÆSTHESIA IN GYNECOLOGY AND OBSTETRICS[1]

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WHILE, in general surgery, extensive use is being made of local anæsthesia, gynecologists seem to have ignored, to a large extent, the possibilities of this form of analgesia, notwithstanding the work of Reclus (14), in France, Schleich (17) and Braun (2), in Germany, Hertzler (8) and Allen (1), in this country, and other authoritative writers. When, in 1913, I (7) advocated local anæsthesia for certain gynecological and obstetrical procedures, a flicker of interest was evinced here and there, but a search through the American literature of the last 10 years has brought to light but a small number of pertinent publications. Yet, continued experience has only served to confirm the correctness of my former attitude, and has even entitled me to enlarge the scope of local anæsthesia considerably beyond my original proposal.

Of the various methods of local anæsthesia, I have tried the blocking of the pudic nerve, as first recommended by Ilmer (9) and Sellheim (18), but gave it up as unreliable, though it is but fair to state that, more recently, King (11) expressed himself as satisfied with it. The parasacral anæsthesia which Braun (2) advocates highly, and the transsacral method which Meeker and his associates (12, 13) practice extensively, efficacious though they undoubtedly are, seem to me rather too complicated for general use and so I have adhered to local infiltration anæsthesia, as recommended by me 13 years ago.

It is the latter form with which this paper will deal exclusively.

LOCAL ANÆSTHESIA IN GYNECOLOGY

In gynecology, it is best suited for certain vaginal operations. The necessary premise for successful anæsthesia is a satisfactory "twilight sleep."

The latter is needed for two reasons. It is required, first, to allay the very natural apprehensiveness of the patient. In this, local anæsthesia does not differ from any other method of rendering an operation painless, whether it be an inhalation narcosis or a spinal anæsthesia. The second, and even more cogent, reason for a preliminary morphine-hyoscine seminarcosis is the imperative necessity of rendering the unnatural position of the patient bearable. Our operating tables have been designed by general surgeons primarily for general surgical operations. The attachment, at the lower end, for vaginal operations is, as it were, an afterthought. In the exaggerated lithotomy position required for such operations, the physiological lordosis is forcibly straightened out, which results in a severe strain of the sacro-iliac synchondroses; and the suspension of the patient's feet on upright leg holders leads to an excessive stretching of the hip joints. Similar unnatural postures were used in the middle ages, and later, in order to inflict punishment or to extort confessions, and few were the unhappy individuals who could withstand the excruciating torture.

In our vaginal operations, we mitigate somewhat this postural pain by supporting the lumbar spine by means of a sand bag, and by raising the leg holders as high as possible; but even this is but a sorry makeshift, and the patient cannot maintain her place more than a few minutes, if her perception of pain were not clouded by a preliminary "twilight sleep."

Our preparations are quite simple. The patient, having secured a good night's sleep by a dose of veronal, receives, 2 hours before operation, a hypodermic injection of morphine grain 1/6 with 1 cubic centimeter of hyoscine (grain 1/135). Her eyes are covered and the ears plugged with cotton soaked in oil. The room is darkened and all noise averted. Family members are not admitted. If, at the end of one hour, pulse and respiration are normal, another injection of morphine grain 1/8 with ½ cubic centimeter of hyoscine (grain 1/270) is given. If pulse or respiration have slowed down, only ½ cubic centimeter of hyoscine is used; and the second injection may be omitted altogether if pulse and respiration seem excessively slow. If, on the contrary, the patient exhibits, after one hour, signs of marked idiosyncrasy in the form of restlessness or hallucinations, the second injection is, likewise, omitted; such a patient is definitely unsuited for local anæsthesia.

The sleeping patient is gently lifted on a stretcher, conveyed to the operating room, placed in the desired position, and cleansed in the usual manner, with this exception that alcoholic or otherwise irritating disinfectants, such as ethereal soap, picric acid solution, or tincture of iodine are not used.

[1] Read at a joint meeting of the Chicago and St. Louis Gynecological Societies, held in Chicago, December 4, 1926.

The standard fluid for the local anæsthesia itself is a ½ per cent solution of novocain, with adrenalin 3 drops to the ounce.

The first group of operations to be considered comprises curettage, amputation of the cervix or other plastic operations thereon, and vaginal hysterectomy.

The technique of anæsthesia is the same in all these procedures. The cervix is exposed, grasped with a tenaculum in either lip, and *gently* pulled down and to one side. Into the lateral fornix thus unfolded, the needle of the syringe is inserted alongside of, and close to, the cervix to a depth of one inch. The direction of the point of the needle, therefore, is a trifle lateral. A resistance encountered indicates that the needle has entered the wall of the cervix; the needle must then be pulled back a little and reinserted. It requires but very little experience to know when the needle is in its proper place in the soft tissue of the parametrium. Ten cubic centimeters of the solution are now injected *while the needle is slowly withdrawn.* The procedure is next repeated on the other side. For major operations, such as hysterectomy, a slightly larger quantity (15 to 20 cubic centimeters) is injected on either side. By this infiltration of the parametria, the large sympathetic ganglion of Frankenhaeuser near the upper end of the cervix is effectively blocked.

After the two injections it is essential to wait from 3 to 5 minutes, until the blanching of the vaginal portion indicates that anæsthesia is accomplished. If the vaginal portion is not discolored completely, a few cubic centimeters may be injected into the space between cervix and bladder, and cervix and rectum, respectively.

Two possible dangers may easily be prevented. The needle may enter a blood vessel and the fluid be thrown into the circulation direct. The result might be a collapse. Braun (2) has collected a number of such accidents; the symptoms, in every case, were alarming but lasted only a short time and left no permanent effect behind. The complication can be avoided by testing, through pull on the piston, whether the needle has perforated a vein, and by injecting slowly and always with the needle in motion.

Another danger may arise from the breaking off of the needle. Steel needles rust easily and break off at the hilt. It is, therefore, important, that the needle should not be inserted its full length so that, if it should break off, it can be extracted without difficulty.

I am pleased to say that I have not yet encountered either of these two undesirable complications.

As to the operations themselves, curettage under local anæsthesia presents no difficulties. The most painful step of this operation is dilatation, particularly if the internal os is narrow and rigid. Under local anæsthesia, this part of the operation is entirely free from pain, and I have the distinct impression that the resistance of the internal os is less than under general narcosis.

Amputation of the cervix under local anæsthesia is not only completely painless, but is definitely easier than under inhalation narcosis, because there is none of the free bleeding which, usually, is such a disturbing and time-consuming factor. The healing differs in no wise from the ordinary course.

I have performed 6 vaginal hysterectomies under local anæsthesia, most of these on elderly, obese, shortnecked women of the type which is not popular with anæsthetists. The indication was cancer of the body in 4 cases and prolapse in 2. In these operations, too, the blood-sparing effect of the local anæsthesia was a very pleasant feature which obviated the usual continuous sponging. The method used was the two-stitch operation designed by Dickinson (4).

Cutting through the parametria was entirely painless; but after this act of the operation was completed, the pull on the infundibulopelvic ligaments caused a definite pain of which the patient seemed to be conscious even though the perception was dulled by the preliminary twilight sleep. Fortunately, this pull is of very short duration, as the adnexa are quickly removed, and the pain can be greatly reduced by the *steady* and *gentle* traction of an intelligent assistant. An additional injection into the upper part of the broad ligaments at this moment appeared to have little effect. It seems entirely permissible to tide the patient over this short duration of sensitiveness by a whiff or two of gas or ethylene or a few drops of ether; and I may say, in this connection, that I do not consider a local anæsthesia imperfect because, at a certain step in any operation, a general anæsthetic has been used to aid the analgesic properties of the local injections. To give the patient this minimum and harmless quantity of inhalation narcosis is merely humane and distinguishes the procedure from the riding of a hobby.

The final step of the hysterectomy, that is, the closure of the peritoneal cavity, the uniting of the stumps of the broad ligaments, and their interposition between bladder and vagina was, again, painless in all 6 cases. Ruge (16) suggested, in 1912, rendering the entire vulvar circumference anæsthetic in all major operations so as to elimi-

nate the pressure pain of retractors, etc. This proposition which is also recommended by Farr (5) seems eminently sound to me.

Anterior colporrhaphies require injections into the layer between vagina and bladder. Only a very small quantity of the solution is needed because the sensibility of the tissues is very slight.

Perineorrhaphies, on the other hand, demand a copious infiltration. The initial injection is made at the lower end of one labium minus. From this point, the needle is thrust along the mucocutaneous border as far as the other labium minus, and the solution is freely injected while the needle is being slowly withdrawn; or else, wheal after wheal is formed, as the needle progresses from one lip to the other. Tenacula can now be placed on either end of the anæsthetized area and traction exerted. The tissues between vagina and rectum are next infiltrated well beyond the extent of the proposed denudation. Finally, 5 or more cubic centimeters are deposited, by deeper puncture, into the levator on either side. If, during the operation, some perception of pain is still evidenced, an additional injection will quickly produce analgesia.

I have approached perineorrhaphies under local anæsthesia only hesitatingly. Influenced, no doubt, by my reading, I feared the inconvenience and time-consuming technique of local anæsthesia, the œdematization of the tissues which would render their differentiation difficult, and the interference with wound healing. Practical experience, however, has convinced me that none of these objections is valid. The injections take but a very few minutes' time; the œdema is not noticeable because a good deal of the fluid escapes as soon as the denudation is made, and the bloodlessness of the tissues makes their proper separation even easier than usual; and, finally, wound healing is not disturbed in any case by the preceding local anæsthesia. In particular it is not necessary to draw the sutures "more tightly so that the tissues are still held in apposition after the fluid is absorbed" (8). In fact, I believe that unsatisfactory results of wound healing in perineorrhaphies are entirely independent of any anæsthetic and are caused by too tight suturing and too thick catgut which resists absorption too long.

Of other gynecological operations under local anæsthesia, I have closed one vesicovaginal fistula (1) and performed vulvectomy for kraurosis in 2 cases.

The Le Fort operation for total prolapse was carried out twice under local anæsthesia. In the last 3 cases of this kind, however, I found that the twilight sleep alone sufficed to render the operation on the overstretched and insensible tissues painless.

Local anæsthesia was, further, used in the repair of third degree tear and in the interposition operation; in the latter there may be a brief sensation of pain when the uterus is luxated into the wound.

Of minor procedures, operations on the urinary meatus, removal of bartholinian cysts, and enlarging of a tight perineum were satisfactorily carried out under local anæsthesia.

I have found local anæsthesia of particular advantage in cases in which extensive vaginal repairs had to be combined with abdominal procedures. The list of proposed operations in such a case usually reads like this: curettage, amputation of cervix, perineorrhaphy, hæmorrhoidectomy, laparotomy for shortening of round ligaments and appendectomy. None of these operations is serious, none requires much time, but their total consumes much time and necessitates a very long inhalation narcosis. In such cases, I nowadays perform all the vaginal work under local anæsthesia and do not commence the ether or gas narcosis until the position of the patient has been changed and the latter has been prepared for the laparotomy.

LOCAL ANÆSTHESIA IN OBSTETRICS

In the realm of obstetrics, local anæsthesia has been used in abdominal cæsarean sections for years. Webster's (22) first operation of this kind took place as early as 1909. Traugott (20) published a series of 12 cases in 1914. The abdominal incision is rendered painless either by infiltrating the abdominal walls in successive layers along the line of the proposed incision or by injecting into the tissues around the incision in the form of an ellipse. The uterus itself possesses no sensibility and may be incised and emptied of its contents without causing discomfort; but any pull or pressure on the parietal peritoneum produces more or less intense pain. It follows, then, that any method in which the uterus is left *in situ*, is better suited for local anæsthesia than the "classical" cæsarean section with eventration of the organ; and since the cervical cæsarean section is constantly gaining in favor among progressive obstetricians, a promising field is being opened for local anæsthesia. For it can hardly be denied that, by local anæsthesia, both mothers and children would be protected from the very obvious disadvantages and dangers of an inhalation narcosis which, beyond a doubt, has been the cause of many a preventable death. Furthermore, local anæsthesia obviates the customary haste in

closing the uterine incision which may result in imperfect adaptation and consecutive weakening of the uterine wound.

I myself did not adopt local anæsthesia for this kind of work until comparatively recently, and as occasions for cæsarean section are not overly numerous, have thus far used it in only 2 cases. The analgesic effect was not altogether flawless, but I ascribe this to lack of technical skill which, with growing practical experience, should improve. In particular, I failed to anæsthetize the parietal peritoneum sufficiently, but the results obtained by De Lee (3), Irving (10), Trout (21), Ross (15), and by Frey (6), to mention but one of the continental writers, leave no doubt as to the perfect feasibility of the method.

Of other obstetrical operations, curettage for incomplete abortion or vaginal anterior hysterotomy in the earlier months of pregnancy are very easily and painlessly performed under local anæsthesia. In these cases, parametric infiltration at the base of the broad ligaments is employed.

It was to be expected that local anæsthesia was also tried in normal childbirth to allay the pain of the second stage. The first attempts go back to the eighties when, soon after the discovery of cocaine, a solution of this drug was applied to the vaginal and vulvar mucosa (Stiassny, 19). Today this method is only of historical interest.

For some time I have been using local anæsthesia systematically in normal labors, principally of primiparous women. At the end of the second stage, when the head first becomes visible during the contractions, the perineal body and the levator muscles are injected in exactly the same manner as has been described above for perineorrhaphies. The analgesic effect is very striking and is particularly impressive in those cases in which the vulvar ring is narrow and has not become softened by the physiological succulence and œdema of the tissues. Within a few minutes after the infiltration, the behavior of the patients undergoes a marked change. They still groan during each contraction and indicate the lower back as the seat of pressure, but their loud complaints and piercing cries when the pelvic floor is forcibly being stretched, cease.

One can well observe that the pain of parturition is composed of two factors: the pressure upon the sacral nerves, and the tearing of the resisting or clonically contracted fibers of the pelvic floor. The former is decidedly the lesser of the two and is rendered quite endurable by the fading effect of the "twilight sleep" injections which the patient had received some time during the first stage. The second component factor is influenced by the local anæsthesia. The levators and the muscles of the perineum relax, the vulvar ring yields and gapes widely, and the child's head passes easily and painlessly through the vaginal opening, without the aid of ether which, heretofore, we have always given during the second stage.

On several occasions I have thus applied low forceps—twice even when deep transverse arrest necessitated rotation—without requiring any ether. In emotional women who bore pain badly, the spectacle of comparative comfort and return to the interrupted "twilight sleep" was certainly impressive.

Then, too, the number and extent of perineal lacerations was distinctly reduced in the patients delivered with local anæsthesia. There was one tear of third degree when a child of 9¼ pounds with persistent occipitoposterior position had to be rotated with forceps; but in the great majority of cases there were no lacerations at all or only very superficial rents in the vaginal mucosa behind the uninjured fourchette, which neither bled nor caused pain when repaired after the birth of the child. The original tightness of the vulvar circumference, however, was attested in several cases by shallow breaks of the mucosa near the vestibule. It may, therefore, be profitable to surround the entire vulva with a ring of infiltration. Episiotomies can, of course, be made and repaired equally easily and painlessly.

Local anæsthesia exerts no influence on the uterine contractions; nor have I seen any ill effects in the sense of later necrosis or infection. The procedure is extremely simple and at the same time convincingly efficacious, and is equally applicable in hospital and home deliveries.

I may add here that, for many years, I have likewise performed circumcisions under local anæsthesia. In these young infants that are still under the obstetrician's care, only novocain is used, without addition of adrenalin, and the space between the two leaves of the prepuce is liberally infiltrated by means of a hypodermic syringe. This renders the cutting off and sewing of the foreskin painless, but the breaking of adhesions to the glans is not affected by the anæsthesia.

SUMMARY AND CONCLUSIONS

The immense broadening out of the field of surgical anæsthesia which is taking place under our very eyes, owes its principal impulse not to a mere desire for innovation but to the realization that there are dangers in anæsthesia which we must try to reduce to a minimum. That local anæsthesia fulfills this desideratum to a very great

extent is long past discussion. That it is not ideally perfect in all respects, may be argued with equal justice, of any other form of human endeavor.

In gynecology and obstetrics it deserves much more attention than it has heretofore received. Certain vaginal operations are particularly well suited for local anæsthesia. Curettage, plastic operations upon the cervix, and vaginal hysterectomy can be rendered painless by infiltrating the base of the broad ligaments with a novocain-adrenalin solution. Colporrhaphies, perineorrhaphies, and a number of other operations require diffuse infiltration of the tissues themselves with the same solution. In every case, a morphine-hyoscine seminarcosis should precede the local anæsthesia.

In obstetrics, abdominal cæsarean section may successfully be performed under local anæsthesia. This applies in particular to cervical cæsarean section. Curettage for abortion and anterior hysterectomy are surprisingly easy when attempted under local anæsthesia.

The employment of local anæsthesia in normal parturition opens a new and promising field for the relief of the excruciating pain of the second stage.

The indications for local anæsthesia are the contra-indications to inhalation narcosis, such as pulmonary tuberculosis, diffuse bronchitis, emphysema in elderly women, heart lesions, arteriosclerosis, and the like.

There are no real contra-indications to local anæsthesia, but there are limitations. A restless patient with an idiosyncrasy against hyoscine is not a suitable subject. If many peritoneal adhesions are likely to be encountered, it would be useless to insist on local anæsthesia. In other words, local anæsthesia should never become a mechanical routine any more than any other form of surgical anæsthesia should ever be the one and only method employed. But with this principle of individualization firmly in our minds, we shall find that in a fairly large percentage of our operative cases, local anæsthesia will best safeguard *all* the interests of our patients.

NOTE.—Since the foregoing was written, I have performed several cæsarean sections in local anæsthesia and with complete freedom from pain, even though in one instance the preliminary injection of morphine and hyoscine was purposely omitted. In addition, a fairly large number of all the various vaginal operations which were mentioned in the body of this paper, have been carried out in local anæsthesia; and the experiences of the last 6 months have, in every way, confirmed the observations and conclusions here presented.

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THE RATIONAL TREATMENT OF TUBAL DISEASE

By C. JEFF MILLER, M.D., F.A.C.S., New Orleans

IT is not an exaggeration to say that the paper which F. F. Simpson read before the American Gynecological Society in 1909, "The Choice of Time for Operation for Pelvic Inflammation of Tubal Origin," was epoch-making in the annals of gynecology. The mortality for this condition, under the old plan of immediate operation, had ranged as high as 20 per cent, but Simpson was able to report for the new principle of delayed operation a series of 456 cases with a death rate of 1 per cent, which was for that time an unparalleled record. His dicta, absolute recovery from the acute attack, a consistently normal temperature for at least 3 weeks, even after thorough bimanual examination, and the complete absorption of the inflammatory exudate surrounding the primary focus of infection, were at first regarded as Utopian and ultra-conservative, but their logic has gradually won them general acceptance, with the result that the prognosis in tubal disease today is decidedly different from what it was a quarter of a century ago.

To physicians who began to practice in the era when immediate operation for acute salpingitis was the rule, the recent literature advocating a return to that plan, long considered happily defunct, is most disturbing. Superficially the results seem good and the arguments seem convincing, but closer investigation at once makes it apparent that the logic is unsound and the reasoning meretricious. It was with the idea of proving once more the better results of conservative treatment of tubal disease that I began to study the most recent operative records of Charity Hospital and of Touro Infirmary in New Orleans, and although the last 300 consecutive cases from each institution very definitely proved my point, I must admit frankly that the figures astonished me.

It had been my opinion, formed from my own practice and from casual observation of the practice of others, that the principles of Simpson were carried out, at least in a modified form, on all of the gynecological services in both institutions, and it was surprising, therefore, to discover that in 292 cases, very nearly half of the total number of 600, operation was done in the presence of fever ranging from 99 to 104, while in 89 other cases the temperature had been normal less than a week. That is, in 381 cases, very nearly two-thirds of the total number studied, the criteria upon which the delayed operation is based were frankly disregarded. The immediate results in these cases, as compared with the results in the cases in which the deferred operation was done, are extremely interesting in the light of the claims which are generally advanced by the advocates of immediate surgery.

It might be well to state at the outset that the champions of the deferred operation base their position on three cardinal points: first, that salpingitis is essentially an infectious disease, with the gonococcus responsible for the greatest number of cases, and that autosterilization by natural processes is the rule in at least 70 per cent, provided sufficient time is permitted for this outcome to occur; second, that the pathology of salpingitis is various, and spontaneous clinical recovery may ensue in any type of the disease, although naturally it is most frequent in the milder types; third, that involvement of the general peritoneal cavity is most exceptional, and death during an acute attack is equally unusual, for which reasons the deferred operation carries practically no additional risk to the patient.

Bearing these criteria in mind, then, let us examine the composite arguments for the immediate operation as they are set forth in the literature.

1. "It is nothing more than common sense that any destructive process should be arrested at the earliest possible moment." With this incontrovertible statement the advocates of both methods will heartily agree, although they differ radically as to how the happy result may best be achieved. Our claim that the process may be more safely left alone than entrusted to surgery is established by the fact that studies of literally thousands of cases have shown that almost invariably these patients show prompt clinical improvement when once the proper rest treatment is instituted, and that a permanent normal temperature is reached within a week or 10 days in some 70 per cent of all cases. Moreover, as is the rule in any disease of bacterial origin, the patient, if let alone, will develop her own immunity, a point proven conclusively by the laboratory studies of Andrews, Curtis, Menge and others, all of which show that the percentage of negative cultures increases in direct ratio to the length of time the case has been cooled. Finally, we need

scarcely point out that the apparent paradox of allowing a debilitating disease to run its course is obviously more logical than is abdominal section in the presence of live bacteria when by a period of waiting exactly the same procedure may be carried out minus this tremendous source of danger.

2. "Granting that active infection is present, its spread is of no more consequence than in operations for appendicitis, indeed less so, since the organisms are usually less virulent." Such a facile dismissal of the dangers of infection within the peritoneal cavity can only be dictated by poor surgical judgment. We have no choice but to interfere in acute appendicitis; delay spells disaster. If a high mortality rate followed expectant treatment and deferred operation in acute salpingitis, this particular argument might have to be respected, but since the contrary is true, why run the chance of spreading an infection, even though it be a mild one? Why risk converting a localized process into a general one? The spilling of infected material within the peritoneal cavity must always be a serious matter, and more than once I have seen septicæmia follow even a gonococcal infection.

3. "Early operation is even more important in salpingitis than in appendicitis, since no one ever wished to conserve an appendix, good or bad, while the conservation of a woman's genital organs is a matter of vital moment to her health and happiness." Granting the argument, the cases are hardly parallel. We have already pointed out that a deferred operation in appendicitis may be fatal, but that the occasional fatality which follows the deferred operation in salpingitis is rarely due to the delayed surgery. Moreover, in appendicitis the operation is done to correct the original pathological condition, while the usual operation for salpingitis is done to correct the *results* of the original condition, which throws an entirely different light on the question.

Granting, for the sake of argument, that the cases are similar, we cannot see that the records of the advocates of early operation show any particular degree of conservatism. For one thing, immediate operation very frequently means unnecessary operation, since a certain percentage of these cases will always recover spontaneously, and abdominal section under such conditions cannot by any process of reasoning be regarded as conservative. In addition, my own experience, which I am sure is paralleled by that of most pelvic surgeons who have lived through the era of immediate operation, is that surgery done for acute salpingitis is almost invariably radical. Since the involvement of the pelvic organs is general and the protective mechanism has not yet been set in order, bilateral salpingectomy must usually be done, and bilateral oophorectomy and hysterectomy are frequently necessary also. In DuBose's report of 255 cases, for instance, in which immediate operation was done, there were 80 hysterectomies, practically a third of the total number, while in our own series of 600, which includes both types of treatment, only 99 were done, a sixth of the total number, and more than two-thirds of these were for fibroids, a positive indication under any circumstances.

The other procedures which are supposed to be practical if immediate operation is done are all, to my mind, of very doubtful value. Splitting and drainage of the tube is enthusiastically advocated by Bourne, but the best that he himself can say of it, since he can show no physiological results in the small number of cases in which he has employed it, is that it at least does no harm. As to partial salpingectomy, I agree entirely with Polak, who remarks rather caustically that the only thing he has ever seen that particular procedure accomplish is to pave the way for a subsequent ectopic pregnancy.

4. "The supposed salpingitis frequently proves to be appendicitis or ectopic pregnancy." Such an argument is specious, for the experienced gynecologist, to whom doubtful cases are presumably referred, can make a differential diagnosis in all but a negligible number. In appendicitis, for instance, the character and location of the pain, the onset and the clinical course of the disease are usually typical, while bimanual examination will practically always establish the diagnosis at once. In tubal gestation also the type of pain and the onset and clinical course of the illness are usually pathognomonic, particularly if there is a history of suspected pregnancy. In addition, Farrar's work on leucocytosis is of real value in doubtful cases, since the fluctuating white count of an ectopic is quite unlike the consistent blood picture in salpingitis. We admit that in the small number of cases in which a differential diagnosis cannot be established between tubal disease and an ovarian cyst with twisted pedicle, exploratory incision is justified, although such a situation very seldom arises.

5. "Rupture of pus tubes is a possibility." It is, but so small a one that such instances are reported in the literature as surgical rarities. For my own part, I should far rather take the chance of having a pus tube rupture while I was treating a patient expectantly than of having to invade

her abdomen while an acute infection was present.

6. "Technical difficulties make the deferred operation very tedious and dangerous." A study of the pathological conditions present in acute salpingitis would seem to indicate that the exact reverse is true, for while the process is still active the structures are so vascular, so infiltrated, and so friable that they are injured by even the gentlest manipulations, while free oozing often demands drainage, a procedure which is always fraught with dangerous potentialities. Under our improved modern technique the enucleation of pus tubes presents no more difficulty to the experienced gynecologist than does any other pelvic surgery, while in my opinion the difficulty of managing adhesions in the deferred operation has been emphasized unduly. When the infection is of gonococcal origin a line of cleavage may usually be found promptly, and although the operation may be more trying when pyogenic organisms are involved, the danger of invading the peritoneal cavity in the face of an active streptococcal infection more than compensates for the slight additional difficulties encountered later.

7. "Postoperative complications are less than in the deferred operation, when fistulæ, infections and residual abscesses are common." On my colored service at Charity Hospital, where the worst types of neglected tubal disease are handled, I can recall only one fæcal fistula in the last 4 years, but I can recall many times that number in the days when I was doing the immediate operation, when the infiltrated and friable bowel was torn in more than one place in an endeavor to release fresh adhesions.

I have no figures at hand except those I have compiled myself, but it is decidedly significant, I think, that of the 82 patients in the series of 600 studied who developed postoperative complications of some sort, 59, nearly 72 per cent, had not been properly cooled. From the standpoint of temperature, which is a legitimate index of convalescence, the results are similar. Of 285 cases in which the postoperative temperature exceeded 101, a normal febrile reaction after abdominal section, 206, 72 per cent, were uncooled patients. Of 208 cases in which the temperature elevation lasted more than a week after operation, 139, nearly 67 per cent, were uncooled. Of the 241 cases discharged with a temperature still above normal, 190, nearly 79 per cent, were uncooled. That is, nearly three-quarters of all the postoperative troubles in the series developed in patients who were not allowed to recover completely from their original infection. In addition, while 14 days in hospital is a generous allowance for the usual abdominal case, in this series the postoperative stay days averaged 20, while DuBose's stay days for his series of uncooled cases averaged 23.3. Certainly these figures do not seem to bear out the claim that the convalescence is smoother when immediate operation is done.

8. "The mortality is lower when immediate operation is done." To this statement we take decided exception, in spite of such brilliant reports as DuBose's, 419 cases with 1 death, and Bonney's, who claims that in 20 years of radical treatment of acute salpingitis he has lost but 1 patient. In the hands of expert men good results sometimes follow even the violation of all the principles of sound surgery, but we would point out that unfortunately most operations are done not by expert gynecologists but by men who are frequently neither experienced nor expert, and it is well, therefore, to inquire how the practice works out when it is generally applied.

In the series of 600 cases studied from the New Orleans hospitals, 57 surgeons are represented. There were 18 deaths, a rate for the entire series of 3 per cent, but it is highly significant that 16 of those 18 deaths occurred in cases which were not thoroughly cooled before operation. That is, 2 of the 219 cooled cases died, a rate of less than 1 per cent, which, we might add, is the accepted risk for surgery of the tubes, but 16 of the 381 uncooled cases were lost, a death rate of 4.2 per cent, or rather more than 4 times as high.

During the 10 years from 1916 through 1925, 6,184 cases of salpingitis were treated at Charity Hospital, partly by expectant and partly by radical measures, yet the death rate for the composite series, in spite of the fact that the majority of these cases were in colored women and that many of them represented the severest types of neglected pathological conditions, was only 2.5 per cent, a figure which we do not hesitate to assert would have been materially lowered if conservative treatment had been the rule in all instances. Holtz lost only 2 of the 400 patients in his series who were operated on after a thorough cooling of the original process, a death rate of .5 per cent, while Ricci in a study of 1,500 cases from the Woman's Hospital reports a mortality rate for the acute cases of 14 per cent, but a rate of less than 1 per cent for the cooled cases. Even a cursory survey of these figures will suffice to show that in discussing mortality rates, it is quite as important to examine the mortality of the average operator as the average mortality of the operation.

9. "Chronic invalidism and sterility are usually the result of expectant treatment." The facts by no means bear out this claim. We have pointed out that a certain percentage of these patients will recover spontaneously after a single attack of salpingitis, and that operation under the circumstances would be unnecessary as well as mutilating, but we might add that a woman who recovers clinically under expectant treatment, even though she does not bear children, is certainly no more absolutely sterile than a woman whose tubes were removed at laparotomy during an acute attack. In a study of 1,083 cases recently published by Holtz, whose figures are to be respected because the follow-up system of the Scandinavian clinics is probably the best in the world, only expectant treatment was employed, yet 12 per cent of pregnancies ensued and there were 82 per cent of complete cures, while only 2 per cent of the patients thus treated were entirely unrelieved. I know of no series of cases treated by immediate operation which can show such brilliant end-results as these.

These, then, are the arguments in favor of immediate operation for tubal disease, as I have gathered them from a survey of the recent literature on the subject. Most of them are specious and practically all of them are controvertible by studies of large series of cases, exactly as they have been by the figures I have quoted to you from the 600 cases I have investigated myself, figures which are certainly more than mere coincidence. The only argument which to my mind has any weight in favor of early operation is that of expediency, since it is frequently impossible to persuade these patients to submit to the necessary periods of rest. In Charity Hospital we have special wards on both the white and the colored services to which such patients are admitted for their infections to cool off, but their ignorance and their social and financial circumstances are frequently such that one is forced to choose between operating before one's better judgment dictates or permitting them to leave the hospital in no better condition than when they entered it. Even with private patients it is not always possible to defer operation as long as one considers it wise, but under no circumstances will I operate upon a patient whose temperature has not been consistently normal for at least 10 days, during which period repeated vaginal examinations have been made.

On my own service the treatment for such cases is routine. Absolute rest in bed during the acute attack and until the temperature has been normal for 10 days or more is the cardinal point in their management. Pain is relieved by local applications, preferably ice caps, and opiates are resorted to only on urgent indications. The bowels are regulated by mild laxatives and gently given enemata; drastic cathartics may be productive of considerable harm, and I cannot agree with Royster that a daily saline is a wise measure. Fluids are forced, by proctoclysis and hypodermoclysis if necessary, and all possible supportive measures are invoked. Hot vaginal douches are given if they add to the patient's comfort, but they are not routine. The course of the disease is checked by bimanual examinations at regular intervals, particular attention being paid to the temperature fluctuations thereafter, and white counts are also made regularly.

Under this treatment possibly 15 per cent of all cases of salpingitis will achieve a permanent spontaneous cure. It has long been realized that this was a possibility when pyogenic organisms were responsible for the original infection, and Curtis has recently reported similarly good results from purely expectant treatment in gonorrhœal tubal disease provided the patient can be kept isolated from the original source of infection. In another group of cases, possibly 10 per cent, the type we see most often on our public services and particularly among colored women, the pathological changes are so extensive that operation is indicated as soon as the case has cooled. Unfortunately, too, because of original neglect and unwise management, radical surgery must usually be done; bilateral salpingectomy was necessary in 243 of the 300 cases studied at Charity Hospital, and unilateral or bilateral oophorectomy was necessary in 218. Between these two extremes, however, lie the great majority of cases, and it is here that the decision must be made on the individual merits of the case. In all instances our aim should be to defer surgery as long as possible, and it is surprising how often cases which were apparently hopeless achieve at least a clinical recovery spontaneously.

When surgery must be done, its extent should be based not only upon the pathological condition present, but upon the age and social condition of the patient, and to a certain extent upon her own desires. Financial considerations naturally cannot be ignored, in our public institutions at least, when conservative surgery might mean the possibility of a second operation.

In general, when the process is tuberculous, both tubes must be removed, and the same procedure is wisest when the infection is clearly of specific origin. Otherwise, greater conservatism is possible, and sometimes the mere release of

adhesions is all that is necessary. Unless the uterus is directly implicated in the infectious process, which is not usual, or is myomatous or otherwise diseased, or is so denuded during operation that a useless organ would be left in situ, its removal is not indicated. In short, hysterectomy should be done on intrinsic indications, and not because extra-uterine disease happens to be present.

Every effort should be made to save ovarian tissue. Frequently in these cases we have to deal with an ovary which is diseased not essentially but because it has been in bad company, and its conservation is always indicated if it seems likely that extirpation of the primary focus of infection will relieve its acquired condition. Oophorectomy, however, is definitely indicated when the ovary is directly involved in the infectious process, when it is riddled with cysts, or when its blood supply has been damaged. In doubtful cases ovarian transplantation is to be preferred to resection if the aim is to avoid symptoms of a precipitate menopause in young women, but its field is limited.

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EDITORIALS

SURGERY, GYNECOLOGY AND OBSTETRICS

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JULY, 1927

"CULT AND OCCULT"

UNLESS a person is deeply interested in a search for truth in a special field, it is better for him to keep an open mind and, with "a decent respect for the opinions of mankind," to travel with the majority, that his energy may be conserved to develop the work in which he has been trained. If he wishes to devote his life to a study of so-called psychic phenomena, it is one thing; but as a side line, investigation of the occult carries distinct danger to integrity of thought. It loosens the mind from the moorings of fact, gives predominance to the lesser senses, and creates emotional disturbances which resemble the instinctive fear reactions of primitive man and the lower animals. One of these reactions was fear in the dark, which remains with us today as a source of emotional disturbance.

Man first recognized only enemies that were large enough to be seen and dangers that could be estimated visually, such as wild beasts, serpents, and tempests. Against phenomena which he could not understand he invoked the protection of his gods.

Through association of ideas, the words *cult* and *occult* have become closely allied. The cultist devotes his energy to the spreading of a special belief not recognized by the majority as resting on a sound foundation. The occultist devotes his time to an attempt to elucidate a belief in hidden and mysterious powers having their origin in a spirit world and to subject them to human control.

Anyone dabbling in the occult, deliberately depriving himself of vision, man's chief means of obtaining information, injures himself mentally. It is a curious ego that in the clear light of reason will prompt one to say of a certain subject, "I do not understand this," and in the dark of suggested psychic influences to say of the same subject, "I believe this is occult," in the sense of a mysterious spirit force. I have known a number of men of great promise in medicine who in the springtime of their lives became interested in a cult or in occultism of the old-fashioned spiritualistic type, which led them to unproved or unprovable hypotheses, blind alleys of belief. As a result, they lost their keen perception of fact and made little progress in their profession.

Sir Conan Doyle, in his masterly characterization of Sherlock Holmes, intrigued the interest of hosts of readers and established a school of detective fiction. Sir William Crookes, the last of the great all-around physicists, made investigations which led to the discovery of the cathode ray, the basis of the X-ray. Sir Oliver Lodge, who so clearly placed before the interested student the fundamental facts in physics, has the gratitude of all. These are three outstanding men of

science who interested themselves in psychic phenomena and believed in reincarnation of the dead. This interest, however, came in the autumn of an intense scientific life. Their great days were over. The new interest was a foil to the critical research of the early days, like the contemplative philosophy of the Orientals.

There is a divine discontent with the existing order of things which leads to progress. Youth is always insurgent, a builder of images, a dreamer of dreams. When guided by scientific imagination youth builds images to be compared with known facts, and dreams true dreams. Age carries mental scars left by experience which contract and shorten vision, but age carries wisdom. Youth and age should travel together; each needs the other for orderly scientific advancement.

The man of 100 years ago who would have attempted to talk about the radio and the wireless would have been regarded as mentally deranged. Had he been able to produce these phenomena they would have been considered occult manifestations from the spirit world, and he probably would have been burned at the stake. Whenever we do not understand existing phenomena, let us lay the lack where it belongs, to a failure of understanding which the future may clear up, and not allow ourselves to prostitute intelligence by talking about fairies, ghosts, spirits, and reincarnation of the dead. W. J. Mayo.

GASTRIC CARCINOMA IN YOUNG PEOPLE

CARCINOMA of the stomach is attracting widespread attention. Intelligent laymen are asking the question: "At what period of life are we immune?" While gastric carcinoma is undoubtedly of exceptional occurrence before the age of 25 years, and its incidence rapidly increases from the thirtieth year on, at no period of life are we immune. Statistical data support this contention. Osler and McCrea's clinical study of 7,000 cases in 1909, and Bernoulli's report of 50 cases in 1907, prove that a diagnosis based to any degree on the tenet of "cancer age" may lead to a fatal issue. Cancer of the stomach has been found in infants only a few weeks old.

It is difficult to make any statement as to the relative frequency of the various microscopical forms of gastric cancer as classified and adopted by a number of observers. Mixed or transitional types are very common, and would probably be found with even greater frequency on examination of the entire specimen instead of only a single portion of the tumor.

A detailed study of several reported cases shows the characteristic picture of carcinoma of the stomach in young people to be sudden onset, violent and rapid course with persistent febrile temperature, absence of cachexia, and early appearance of metastases. The rendering of an early diagnosis is even more difficult here than in gastric cancer at a later age. There are only three features by which these juvenile cancers differ from those seen in older patients: absence of cachexia, early onset of high temperatures, and early formation of metastases.

A study of the symptoms of cancer of the stomach in the young as compared to those seen in older patients presents no essential differences, although genuine cachexia appears to be less common in the early decades of life. Often merely anæmia is found, with an otherwise fairly good nutritional condition. A progressive anæmia, combined with constant pain, may give the physician a clue in an otherwise obscure case. An erroneous impression that a malignant process is impossible at an

early age of life may prevent the diagnosis of carcinoma being rendered. An X-ray study and the proper use of gastric catheterization are important diagnostic aids, for timely recognition and removal of the cancer are especially important, in view of the tendency to a remarkably rapid course. Prolonged duration is the exception. Surgical interference proves inefficient when it comes too late for radical removal of the primary growth and prevention of metastases. The future will have to show if the onset of malignant disease can be discovered by improved serological methods.

Surgical interference is indicated in all cases in which the removal of the tumor and its immediate metastases seems to be possible. Operative treatment also should be given when the neoplasm has led to stricture of the cardiac or pyloric orifice of the stomach. It will be found that an exploratory operation is called for in most cases, unless there are contra-indications against surgical interference, due to the general condition of the patient or to the behavior of the malignant tumor itself.

Much publicity has been given to non-operative methods of treatment. Results from irradiation by X-rays or radium have not been encouraging and their use is applicable only as a last resort. Though serum therapy is claimed occasionally to have exerted a beneficial action, its results are neither uniform nor reliable. Purely medical care of a case is of necessity limited to the treatment of symptoms, especially pain and starvation.

A study of the subject leads to the following conclusions: Gastric carcinoma in young people should be considered more often; the sudden onset, rapid course with persistent febrile temperature and progressive anæmia without cachexia in a young person complaining of gastric distress and pain should raise the suspicion of carcinoma; surgical treatment should not only be early, but as radical as possible. RAYMOND P. SULLIVAN, M D.

MEMOIRS

MEMOIR—CHARLES HOWARD PECK

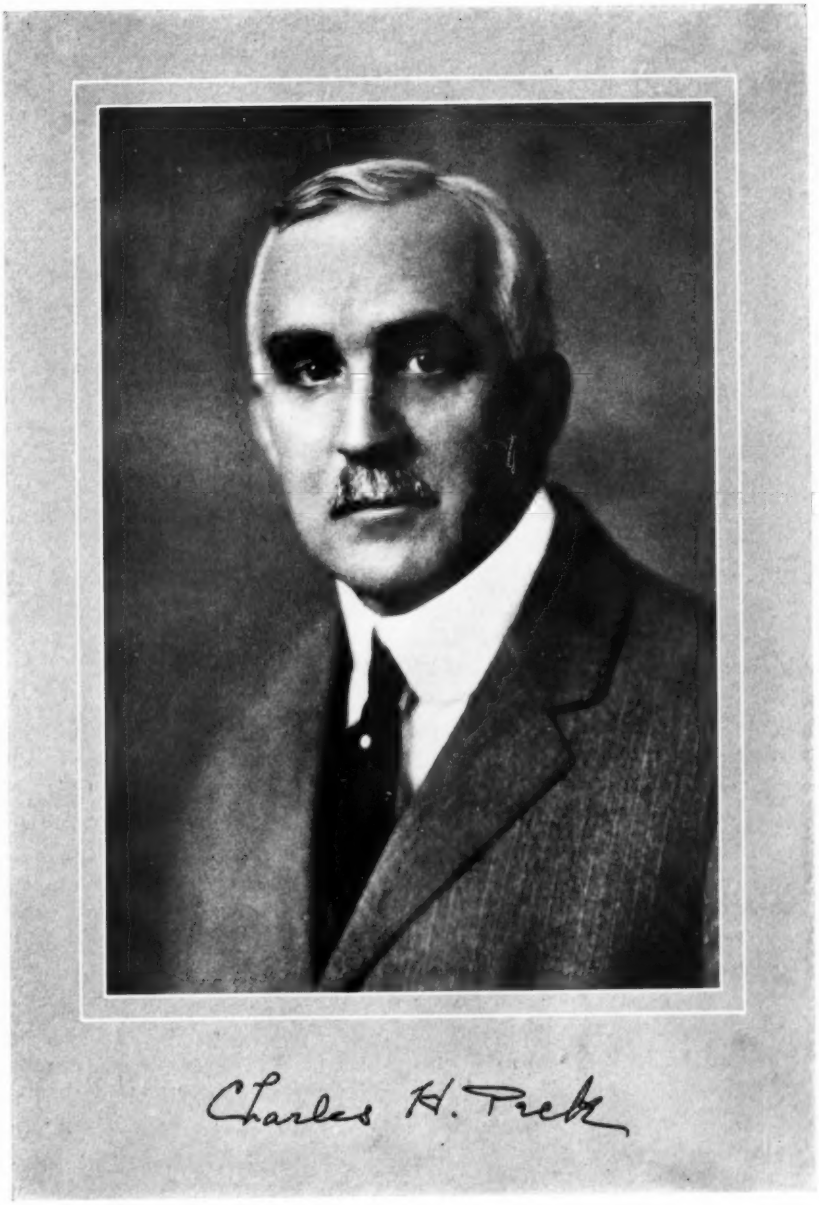
Born June 18, 1870—Died March 28, 1927

IT is with a sense of deepest personal loss not unmixed with sorrow that I record the passing of Dr. Charles Howard Peck, master surgeon, earnest patriot, distinguished teacher, benefactor of mankind, and my friend. An association of twenty years begun in the formative, youthful days of our earliest professional efforts and ripening into closest companionship, closed when he answered the final summons March 28, 1927.

Such intimate acquaintance afforded abundant opportunities to observe and admire a many-sided character, beautiful in its simple faith, strong in its devotion to study, unyielding in its adherence to principle, superb in its fidelity to friends and professional contemporaries. A brilliant, full and varied career, brought to an untimely close at the height of its productiveness, cut down at the full tide of its usefulness, emphasizes how much service may be crowded into an all-too-brief period of existence. Few gave more than he in the short span of fifty-six years allotted to him; few accomplished so much in their chosen walk of life; and of few may it be more truly said, that those who knew him best loved him best.

Appreciation is measured in superlative terms by friends, but in this instance, deservedly so, as is evidenced by the manifold tributes and expressions of sorrow among companions, acquaintances, and people of all walks of life. Of his many admirable qualities, the kindliness, charity, and benevolence of his friendship endeared him most, I think. The supreme happiness which he enjoyed in the companionship of his professional associates, and their confidence and appreciation of his talents, signify the high plane of ideals which governed his every action. Quiet, kindly, cheerful, without malice, zealous in any cause he espoused, earnest in the execution of his duties, he moved among his fellows, an example and inspiration to all.

His unselfishness and self-sacrificing intent is nowhere better illustrated than by his distinguished war record. Actively engaged in teaching, and busy with a large private practice, his patriotism prompted him to join the colors immediately upon the admission of the United States into the World War, and he served with credit and distinction throughout its course, in France, receiving merited



Charles H. Preble

decorations from his own and foreign governments. Commissioned a Major at the outbreak of war, Dr. Peck organized and directed Base Hospital No. 15, which early arrived in France and was stationed at Chaumont from July, 1917, to July, 1919. During this time he served first as senior consultant in surgery in the American Expeditionary Forces, and in August, 1918, he was transferred to the Surgeon General's office in Washington, D. C., as a chief in the department of general surgery, where he remained on duty until his honorable discharge from service with the rank of Colonel, February 4, 1919. He was awarded the Distinguished Service Medal of the U.S.A., March 26, 1919; the French government made him an Officier de l'Instruction Publique, French Republic, and for services rendered during the second battle of the Chemin des Dames, October, 1917, he was quoted in orders "for service rendered to the French Army" and he was made an honorary member of the 68th Battalion Alpine Chasseurs. A son, Charles Howard Peck, Jr., made the supreme sacrifice in France, serving in his father's unit.

No less distinguished was Dr. Peck's career as surgeon and teacher. Graduating at the early age of twenty-two years, in 1892, at the head of his class, from the College of Physicians and Surgeons, Columbia University, he served three years in the New York Hospital, engaging in private practice after this, with appointments first as assistant to the Hudson Street Hospital, New York, for two years (1895–1897), attending surgeon to the French Hospital (1897–1899), then on the surgical staff of the Roosevelt Hospital January 1, 1904, serving through the various grades until the date of his death. He was actively engaged in the teaching of surgery in his Alma Mater from 1900 until the time of his death; he had been professor of clinical surgery since 1910. Numerous other hospital appointments fell to his lot, among them: consulting surgeon to the Ruptured and Crippled, New York City; to the White Plains Hospital and Nyack Hospital, New York; to the Vassar Brothers Hospital, Poughkeepsie, New York; and to the Greenwich and Stamford Hospitals, Connecticut.

As a surgeon, he was resourceful, meticulous, noted for kindliness to tissue and scrupulous hæmostasis, skillful in operative maneuvers, and possessed of a mature judgment, the fruit of long and ripe experience.

Honored by membership in many surgical societies, he served as president of the Society of Clinical Surgery; treasurer of the American Surgical Association and member of its council from 1915 until the time of his death; fellow of the American College of Surgeons and member of its Board of Regents; president of the New York Surgical Society; vice-president of the New York Academy of Medicine; member of the American Medical Association and chairman of the section on surgery, 1915; member of the New York County Medical Society, and president, 1919; member of the New York State Medical Society; member of the International Surgical Association; and others.

While not a prolific writer, Dr. Peck's contributions to surgical literature were marked by their evidence of thorough study and extensive experience, by their concern of problems of deep interest at the time of their publication and by a scholarly diction, clearly expressed, and definite and worth while viewpoints. His interests covered the broad field of general surgery with a grasp and knowledge which compelled his recognition as a leader of his chosen profession.

CHARLES H. MAYO, M.D.

Novum Lumen Chirurgicum:

OR, A

NEW LIGHT OF CHIRURGERY.

Wherein is Diſcovered, a much more Safe and Speedy way of *Curing* WOUNDS, than hath heretofore been uſually Practiced.

Illuſtrated with ſeveral Experiments made this Year in Flanders.

Authore

JOHAN. COLBATCH, *Med.*

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Printed for *D. Brown*, at the *Bible* and *Swan* without *Temple-Bar*, 1695.

Novum Lumen Chirurgicum Vindicatum:

OR, THE

NEW LIGHT OF CHIRURGERY VINDICATED

From the many unjuſt Aſperſions of ſome unknown Calumniators.

With the Addition of ſome few Experiments made this Winter In *England*

By Jo. Colbatch, *Phyſitian.*

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THE SURGEON'S LIBRARY

OLD MASTERPIECES IN SURGERY

By ALFRED BROWN, M.D., F.A.C.S., Omaha, Nebraska

JOHAN COLBATCH'S NEW LIGHT ON SURGERY

QUACKERY and charlatanism ever present though they are in all lines of endeavor, seem nevertheless to have singled out medicine as the object of their greatest attack. The fact that the structure and functions of the human body lie in a realm unexplored by the average layman lends to them an element of mystery which leads, even among the intelligent, to a credulity which in any other field of activity would be looked on as inane. This has gradually bred in the medical mind a defense reaction which shows itself as suspicion in its mildest, and disbelief, if not total disregard of anything new, in its more developed form. Though this defense reaction has led to delay in the acceptance of many of the great discoveries in medical science, still it has been a saving grace; for innumerable ideas, evolved from thin air and unproven from the standpoint of experiment or clinical fact have fallen by the wayside without ever having had the opportunity to do any definite harm. This has led to the unwritten dictum that before any idea, especially in the therapeutic side of medicine, can gain a foothold the fundamentals upon which it is based must be published freely and the entire story laid openly before the profession as a whole. From time to time attempts to commercialize a discovery in medicine have been made but without success. The reason for this failure is self-evident, for the promulgator of a new idea who chooses a method of promotion contrary to the standards of his profession is generally of such low grade that the product of his endeavor is worthless.

On the other hand there are examples in medicine and surgery of men who in the beginning of their careers, classed with the unintelligent if not with the charlatans, have by constant and unfailing effort forced the regular profession to recognize their work as sound and finally to accept them into the fold. Johan Colbatch belonged in this class. He was not a graduate physician but an English apothecary who believed he had discovered an infallible remedy for healing wounds, which was made up of two parts, a so called vulnerary powder and a tincture to be taken internally. He explains the origin of his idea as follows: "Having for a long time been much dissatisfyed with the common methods of Chirurgeons, in the cure of Recent Wounds; and almost every day, observing the inconveniences that attend those People who had occasion to make use of them; therefore for my own satisfaction, and Mankind's good, I took into Consideration, whether their Methods were agreeable to Reason, and the subject upon which they wrought. At last I was fully satisfied, that their Practice was most unreasonable, which I shall endeavor to evince, with as much brevity and accuracy, as the unsettledness of my present condition will admit of: Which when I have done, I shall lay down my own Hypothesis; which I doubt not to confirm both by Reason and matter of fact; which is the most clear sort of demonstration." Apparently having made up his mind that surgical results were not all they should be, he began to concoct various medicines to answer his hypothetical requirements of proper physiological action. He was then ready to test them out and did so by animal experimentations for in his introduction to the reader he says: "Having at length lighted upon a pair of medicines, the one Internal and the other External, which I supposed would answer my Intentions; I began to make Experiments upon Dogs and other Animals. Wounding them in the most desperate manner I could contrive; and in about a Hundred Experiments that I made, I had not above five that miscarried." Then he introduced the usual cry of the individual who, whether rightly or not, believes himself persecuted—"three of which were made before the Right Honourable the Lord Cut's; but two of these three, as I can plainly make appear, after the danger was over, were Poysoned. I was likewise much abus'd in a Soldier of his Lordship's Regiment, whom after my medicines had set him free from all ill Symptoms, and he almost well, in my absence for four or five Hours, (having before for five Days and Nights, been constantly with him, for fear of Roguery) was made Drunk, but by whom I know not, and in an hour or two after my return he Dyed." Following these experiments Colbatch made a large supply of his medicines and started on his own initiative for the wars in Flanders, where he was allowed to try his experiments with, according to his statement, great success. He was continually at variance with the regular surgeons. But in the end he was elected a member of the College of Physicians and himself became a regular. What his medicines were he does not tell, so his secret died with him and we must form our own judgment as to whether they or his careful washing of the wounds and avoidance of irritants were responsible for his good results.

REVIEWS OF NEW BOOKS IN SURGERY

As we speak of a poets' poet, so, in medicine, is there an historians' historian. Sudhoff[1] is best loved and most appreciated by medical historians themselves. He has motivated and directed the study and writing of medical history on a larger and more comprehensive scale than ever before.

That this is so, we in America quite generally recognize. But, unfortunately, that recognition is not based upon knowledge. For but little of Sudhoff has been translated, and that little is thinly scattered. His original German—astoundingly difficult, semi-archaic—is only for those well-versed in the German idiom, or men of abundant leisure. So it is that the common run of us have accepted his greatness as a matter of faith, based upon references to him, and an intuitive perception of hidden, massive genius.

One might misjudge him from reading this book, unless one remembers that its essays are selections—mainly by the Master himself—from his shorter and minor papers. Some portions of his greater work are here, in an essay on Galen, essays on prehistoric medicine, and on the new methods of attack he has developed in prehistoric and mediæval medicine, and in epidemiology and hygiene. For an example, he found historical food in "Hygienic Directions for Travellers During the Middle Ages." One of his refutations of the theory of American origin of syphilis is here; and there is much beside the history of medicine: Garrison's fine sketch of Sudhoff, and bits of Sudhoff's related thought—philosophy, art, letters—and his guiding spirit, Goethe.

It is not a book of individuals and individual advances, but of points of view, eras, trends, causes, and effects, and—most of all—stimuli. Almost as often as he solves problems, he points out those still awaiting solution. We do miss the excitement of action, but in its stead are incited to action.

These essays are minor—but only in relation to the enormous figure of Sudhoff. The very fact that Garrison and a group of men such as Krumbhaar and Ruhräh have effaced themselves in the thankless burden of translation assesses their worth in the field of historiography.

JOHN FALLON.

STEVENS MEDICINE[2] appeared first in 1922 and was immediately popular, being reprinted twice in 1922 and again in 1923. It is now entirely revised after an interval of 4 years and is a worthy candidate for the position of a standard students' text. The discussion of various subjects reflects the most recent scientific clinical investigations. The presentation of the subject of diabetes is clear and forceful. We would be inclined to emphasize somewhat more the importance of glycæmia levels and the energy value of insulin for the average working diabetic, but this is merely a difference in point of view. The Volhard and Fahr classification now so commonly adhered to, is presented. It clarifies this complicated subject even if it may not be fundamentally correct. The discussion of hyperthyroidism seems sound.

The presentation is simple and lucid, and the text is modern, correct, and easily comprehended.

PAUL STARR.

IN a publication,[3] appearing from time to time in single volumes, devoted as the name would suggest to the practical problems of diagnosis and treatment, the contributions to the present volume come from the surgical clinic of the University of Leipzig. "Peritoneum" by O. Kleinschmidt, "Appendicitis" by E. Payr, and "External Hernia" by J. Hohlbaum comprise the contents. Payr's contribution deserves special mention. The article, in fact, is an extensive monograph on the subject of appendicitis. In addition to a discussion of the diagnosis, pathology, and treatment of acute appendicitis, there is an exhaustive treatise on the attending complications of the disease.

GEORGE HALPERIN.

THE variety of subjects discussed by Volkmann[4] in his recent book is amazing. In the first part the author covers general surgical preparedness. This includes 23 chapters concerning the arrangement and location of the operating room, asepsis, selection of anæsthesia, hæmostasis and other allied subjects. In addition, surgical risks are considered: those cases in which the complications are diabetes, acidosis, alkalosis, or hæmophilia. In this section, cases requiring pre-operative roentgen therapy are discussed. Of particular interest are the methods of determining whether the patient's heart will be able to successfully tolerate the surgical shock. The chapter on anæsthesia conveys in general the opinions of H. Braun, excepting that the author favors sacral anæsthesia induced through the sacral hiatus, for properly selected cases. Chloroform is used far more extensively there than in America.

The last 80 pages deal with pre-operative care in the treatment of individual organs or in preparation for certain operations. Particularly well developed are the chapters on stomach surgery and prostatectomy.

[1] ESSAYS IN THE HISTORY OF MEDICINE. By Karl Sudhoff, M.D. Translated by various hands and edited, with foreword and biographical sketch, by Fielding H. Garrison, M.D. New York: Medical Life Press, 1926.

[2] THE PRACTICE OF MEDICINE. By A. A. Stevens, A.M., M.D. 2d ed., entirely reset. Philadelphia: W. B. Saunders Co., 1926.

[3] DIAGNOSTISCHE UND THERAPEUTISCHE IRRTUEMER UND DEREN VERHUETUNG. "Chirurgie," by Prof. Dr. J. Schwalbe, 8th vol. "Peritoneum," by Prof. Dr. O. Kleinschmidt; "Appendicitis," by Geh. Med.-Rat. Prof. Dr. E. Payr; "Aeussere Hernien," by Prof. Dr. J. Hohlbaum. Leipzig: Georg Thieme, 1926.

[4] DIE VORBEREITUNG ZU CHIRURGISCHEN EINGRIFFEN. By Dr. Med. J. Volkmann. Berlin: Julius Springer, 1926.

This book fills a definite need in medical literature and its only fault lies in its limited length as compared with the magnitude of the subject.

SAMUEL J. FOGELSON.

IN a monograph[1] of 170 pages on the study of cardiovascular disorders in cases of traumatic arteriovenous aneurisms, the author states that his object is to call attention to the cardiac changes that occur in these cases. The literature barely mentions these changes, the author finding them described in only 27 of 780 cases reviewed.

This work should be of particular interest to those who are devoting much time to surgery of the blood vessels.

A brief history of the subject and a description of the pathological anatomy of traumatic arteriovenous aneurisms are followed by a discussion of the pathological physiology in these cases. The author describes an arteriovenous aneurism as a short circuit in the peripheral circulation which produces a disturbance in the equilibrium that normally exists between the heart, capillaries, tonicity of the arterial walls and the volume of circulating blood.

The circulatory disturbances present in arteriovenous aneurisms, the various views held to account for the cardiac enlargement, and the procedure that should be followed in these cases are each the subject of a chapter. Elimination of the aneurism by any surgical means restores the equilibrium of the factors regulating the circulation of the blood and normal conditions will follow.

A review of the 27 cases reported in which cardiovascular changes were noted is followed by a fairly extensive bibliography on this subject.

R. W. MCNEALY.

IN the foreword to the first volume[2] of what is to be an extensive handbook on urologie, the editors note the absence of any recent thorough and complete work on urology in the German literature and plan to remedy this defect. We may, therefore, conclude that their work aims to be encyclopedic in character.

Students of urology cannot escape the fact that there are fundamental differences between the German and American schools of urology. In America, urology has proceeded from men who were essentially great surgeons and has taken part in the general surgical advance which has occurred in this country. As a result it has become highly perfected mechanically with little purely scientific development, much of the work in physiology and pathology having been left to internists, physiologists, and pathologists. In Germany a more scientific viewpoint has prevailed and as a result we have seen its literature enriched with many extensive and valuable contributions from urologists to the physiology and pathology of the urinary system. The physiological point of view has pervaded urological surgery so that discussions of the neuromuscular mechanism of the bladder, for example, are more common than the presentation of methods of removing constrictions of the vesical orifice.

The volume under consideration exemplifies this difference very well. It comprises a number of chapters on the general surgery of the urogenital tract, followed by sections on its pathological physiology, and on the examination of the urine. While the chapters on general surgery include only the more fundamental procedures in the case of each organ, they yet give to the American urologist an impression of being distinctly elementary. A further point that cannot escape consideration is the marked lack of references to work which has been done outside Central Europe. The references to recent American work are extremely few and evidently selected at random since most of the important contributions are omitted. It may be said that American surgeons will find little in these chapters that is new to them with the possible exception of the detailed description of Voelcker's ischiorectal method of approach to the prostate.

The sections on pathological physiology fall in an entirely different category. They include the pathological physiology of renal secretion, the innervation of the kidney, the normal and pathological physiology of the ureter, the pathological physiology of the bladder, and the pathological physiology of the male sexual organs. Here is a wealth of highly valuable knowledge brought together by authorities and, in contrast to the surgical chapters, documented from the literature of all countries. In the sections on the kidney the distinction between nephritis and the changes produced in the kidney by obstruction, while made, is not insisted upon as strongly as it usually is in American works. Sections on the ureter and bladder are particularly complete and will repay reading by anyone interested in the complicated problems associated with these organs.

The section devoted to the bacteriological, chemical, and microscopic examination of the urine is exceedingly complete from every point of view except that no consideration is given to the extremely interesting modern work (which by the way has emanated largely from Germany) on the colloidal phenomena of the urine.

This work evidently constitutes a great and serious effort on the part of German urologists, and the forthcoming volumes will be awaited with much interest.

DAVID M. DAVIS.

A SMALL work by Pierre Pauchet[3] really comes from the Paris clinic of Victor Pauchet, who in writing the preface advises first medical treatment for ulcer, then surgical treatment after

[1] CONTRIBUTION A L'ÉTUDE DES TROUBLES CARDIO-VASCULAIRES DANS LES ANÉURISMES ARTÉRIO-VEINEUX TRAUMATIQUES. By Dr. Edouard Desjardins. Paris: Louis Arnette, 1926.

[2] HANDBUCH DER UROLOGIE: ALLGEMEINE UROLOGIE. ERSTER TEIL: CHIRURGISCHE ANATOMIE, PATHOLOGISCHE PHYSIOLOGIE, HARNUNTERSUCHUNG. Edited by A. von Lichtenberg, F. Voelcker, and H. Wildbolz. Berlin: Julius Springer, 1926.

[3] LE TRAITEMENT DE L'ULCÈRE DU DUODENUM. By Pierre Pauchet. Preface by Victor Pauchet. Paris: Gaston Doin & Cie, 1926.

the third attack when it is necessary. Anglo-Americans are credited with the insistence of differentiation between duodenal ulcer as opposed to stomach ulcer in 1910.

Fourteen conclusions at the end of the exposition really cover the author's intention. Among them he says duodenal ulcer is called the most medical ulcer; medical treatment should be persisted in under certain conditions for a period of not over one year if there is no improvement. Medical treatment should also be used for those patients unable to withstand operation and as a follow-up after operation.

With hæmorrhage, hyperacidity, prolonged pain, and permanent deformity of the bulb, operation promises relief. A patient who suffers pain from digital pressure over the ulcer is menaced by perforation and the ulcer should be resected.

It is advised that the gall bladder and appendix should be inspected during operation and treated if diseased.

If no duodenal ulcer is found on exploration, gastro-enterostomy should be performed. Gastro-enterostomy will not cure all cases of ulcer. Cauterization of the ulcer is advised when the duodenum is movable and the acidity is low; likewise, Finney's operation is applicable to the same conditions.

Duodenopylorectomy is excellent for mild acidity and pylorospasm; gastrectomy is the treatment of choice for high acidity and hæmorrhage. In severe hæmorrhage, medical treatment should not be persisted in over 36 hours; operation is then indicated. Duodenal ulcer complicated by peptic ulcer after entero-anastomosis should be treated by gastrectomy if there is still hyperacidity.

KELLOGG SPEED.

A PICTURE of Mackenzie[1] has been written which is most impressive and inspiring. His start in life at the age of fifteen as an apothecary's assistant and his end as the courageous pioneer in the science of medicine is dramatically presented. It is a devoted and occasionally extravagant eulogy of a great man. It is not meant to be a definitive biography. Mackenzie's development and the source and sequence of his theories are enthusiastically expounded and they are, of course, most interesting although of almost impossible simplicity. The book makes absorbing and stimulating reading and gives the impression of being a genuine portrait.

PAUL STARR.

WHILE there is nothing startling or new presented in Thomson and Gordon's monograph[2] on rheumatic diseases, it is a very clear, concise exposition of this important subject. The book is very well written and it is easily read. There are no over-enthusiastic statements.

The chapter on fibrositis is very good. As an illustration of the economic importance of this subject, it is stated that two million pounds a year are spent on sick benefits from rheumatic diseases in Great Britain.

The authors believe that heredity and inherited diatheses are important factors. They present a special chapter on climacteric arthritis which they believe is usually of metabolic origin.

All forms of chronic rheumatic diseases are discussed, including brachial neuritis, lumbago, sciatica, intercostal neuralgia, arthritis of various types, and gout. Under the principles of treatment there are discussed drug treatment, hydrology, climate, physiotherapy, orthopedic treatment, vaccines, and diet.

It is a book that can be safely recommended to everyone interested in arthritis and its numerous allied conditions.

PHILIP LEWIN.

A DELIGHTFUL narrative, somewhat choppy in spots, of the life and time of Adolph Kussmaul[3] appears in a little volume of 131 pages. It is a reprint from the *Annals of Medical History* of June, 1926. Those who read Dr. Bast's article in the *Annals* will welcome its reissue. The narrative has been rounded out and has been presented in somewhat better form. The first part is based on Kussmaul's autobiography.

Professor Bast has called attention to an error generally accepted in Germany, giving Kussmaul credit for the earliest use of the stomach tube. He quotes Dr. Smithies: "To the average German physician, credit for the stomach tube and its employment goes to Kussmaul." Authority is cited showing the employment of the stomach tube by Alexander Monro in 1797. Later, as is shown, Philip Syng Physick and Physick's nephew, John Syng Dorsey, used the stomach tube early in the nineteenth century. One recalls also John Hunter's paper of September 21, 1790, in which he describes the employment of a stomach tube for the purpose of feeding a patient unable to swallow; the idea occurring to Hunter because of his use of such an instrument in introducing food into the stomachs of experimental animals.

The reader is introduced anew to Kussmaul's accurate clinical observations; his versatility as clinician and experimentalist; as author and poet. The value of the volume is enhanced with a Kussmaul bibliography.

IRVING S. CUTTER.

THE second of the three volumes in a series on anatomy by Deaver[4] treats of the upper extremities, neck, shoulders, back, and lower extremities. It continues the excellent presentation of the first volume, and the revision and rearrangement make it even more valuable than the favorably

[1] THE BELOVED PHYSICIAN, SIR JAMES MACKENZIE. By R. Macnair Wilson. New York: The MacMillan Company, 1926.

[2] CHRONIC RHEUMATIC DISEASES; THEIR DIAGNOSIS AND TREATMENT. By F. G. Thomson, M.A. (Cantab.), M.D., F.R.C.P. (Lond.), and R. G. Gordon, M.D., D.Sc., M.R.C.P. (Edin.). New York: Oxford University Press, 1926.

[3] THE LIFE AND TIME OF ADOLPH KUSSMAUL. By Theodore H. Bast, Ph.D. New York: Paul B. Hoeber, 1926.

[4] SURGICAL ANATOMY OF THE HUMAN BODY. By John B. Deaver, M.D., Sc.D., LL.D., F.A.C.S. 2d ed. vol. ii. Philadelphia: P. Blakiston's Son and Co., 1926.

known original work. In text and elegance of illustration little is left to be desired. This is essentially the standard reference for the advanced student and practicing surgeon. The tyro can profit much from the plates and from descriptions of selected regions, but a systematic simpler treatment should serve as his introduction to surgical anatomy. L. B. A.

VOLUME ii of *Ergebnisse der medizinischen Strahlenforschung*,[1] like volume i, consists of a number of exhaustive monographs dealing with various radiotherapeutic or roentgenodiagnostic problems. Each one is admirably presented, consideration being given to practically every phase of the radiological investigation of the subject. Each monograph is in fact a collective review of the literature pertaining to the matter under discussion so combined with personal experience as to form an authoritative, scientific, and practical summary of our present-day knowledge of that subject. The book is profusely and well illustrated, and an extensive bibliography is appended to each section. As a reference work, it forms a most valuable contribution to radiological literature.

The topics on diagnosis include ventriculography by Juengling, myelography by Peiper, interlobar pleurisy by Fleischner, and duodenal ulcer by Berg. The first two subjects are discussed from the historical, anatomical, physiological, technical, and diagnostic angles and special consideration is given to clinical application, indications, contra-indications, and untoward effects. Fleischner emphasizes the need of knowledge of anatomy in the direct and differential diagnosis of interlobar conditions. Berg stresses the direct roentgen findings of duodenal ulcer; he shows how they are related to the pathology and estimates their clinical value.

An article by Kroetz deals in detail with the effect of short wave radiation upon the acid-alkali balance in the body, particularly as regards the reaction in the blood. Geller discusses the results of experimental radiation of the ovary relative to its effects upon the individual cells, the organism as a whole, and upon pregnancy, and correlates them with the practical aspects of radiotherapy of these organs.

Radiotherapy of bronchial asthma is covered by Klewitz from the standpoint of rationale, technique, and results. Carcinoma of the tongue, as treated by roentgen rays and radium, is discussed by Schemp as regards pathology, radiosensitivity, effect of various techniques and indications. Scheele presents an article on endovesical electrocoagulation which deals mainly with technique, indications, and results.

ADOLPH HARTUNG.

[1] ERGEBNISSE DER MEDIZINISCHEN STRAHLENFORSCHUNG (ROENTGEN DIAGNOSTIK, ROENTGEN-, RADIUM- UND LICHTTHERAPIE). By H. Holfelder, H. Holthusen, O. Juengling, H. Martius. Vol. ii. Leipzig: Georg Thieme, 1926.

BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

DIAGNOSTIC DES PRINCIPAUX CANCERS. By Henri Hartmann. Paris: Masson et Cie, 1927.

DIE WIRKUNGSWEISE ABGESTUFTER KEIMDRUESENSCHAEDIGUNG; EINE EXPERIMENTELLE STUDIE ZUR FRAGE DER ENDOKRINEN SEXUALFUNKTION. By med. Dr. Heinrich Viktor Klein. Berlin and Wien: Urban & Schwarzenberg, 1927.

DIE SCHWANGERSCHAFT AUSSERHALB DER GEBAERMUTTER. (Diagnose und Differentialdiagnose.) By Prof. Dr. Robert Zimmerman. Leipzig: Georg Thieme, 1927.

LES CANCERS DU SEIN. By Pierre Delbet et Mendaro. Paris: Masson et Cie, 1927.

CHIRURGISCHE ROENTGENOLOGIE; EIN GRUNDRISZ DER ANWENDUNG DER ROENTGENSTRAHLEN IN DER CHIRURGIE MIT EINEM ANHANG RADIUMTHERAPIE. By Dr. Hans Kurtzahn. With a foreword by Prof. Dr. M. Kirschner. Berlin and Wien: Urban & Schwarzenberg, 1927.

HANDBUCH DER BIOLOGISCHEN ARBEITSMETHODEN. By Geh. Med.-Rat Prof. Dr. Emil Abderhalden. Lieferung 224. Die gerichtsaerztliche Untersuchung des gesunden and kranken Menschen. Berlin: Urban & Schwarzenberg, 1927.

SURGICAL APPLIED ANATOMY. By Sir Frederick Treves, Bart. 8th ed. rev. by C. C. Choyce, C.M.G., C.B.E., B.Sc. (N.Z.), M.D. (Edin.), F.R.C.S. (Eng.). Philadelphia and New York: Lea & Febiger, 1927.

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A TEXTBOOK OF EXODONTIA; EXODONTIA, ORAL SURGERY AND ANESTHESIA. By Leo Winter, D.D.S. St. Louis: The C. V. Mosby Company, 1927.

THE CONQUEST OF DISEASE. By Thurman B. Rice, A.M., M.D. New York: The Macmillan Company, 1927.

ÉLÉMENTS D'OBSTÉTRIQUE. By V. Wallich and Ed. Lévy-Solal. Paris: Masson et Cie, 1927.

HARELIP AND CLEFT PALATE; CHEILOSCHISIS, URANOSCHISIS AND STAPHYLOSCHISIS. HISTORY, ETIOLOGY, DEVELOPMENT, ANATOMY, PHYSIOLOGY, TYPES, SURGICAL AND NON-SURGICAL TREATMENT, AND REPORTED CASES. By Matthew N. Federspiel, B.Sc., D.D.S., M.D., F.A.C.S., F.A.C.D. St. Louis: The C. V. Mosby Company, 1927.

PRACTICAL CHIROPODY. By E. G. V. Runting, F.I.S.Ch. 2d ed. St. Louis: The C. V. Mosby Company, 1927.

I TUMORI DELLA GHIANDOLA CAROTIDEA. By G. Aperlo and F. Rossi. Milan: Dottor Francesco Vallardi, 1927.

METHODS AND PROBLEMS OF MEDICAL EDUCATION. 6th Series. New York: The Rockefeller Foundation, 1927.

THIS BUSINESS OF OPERATIONS. By James Radley. Foreword by J. M. Withrow, M.D. Cincinnati: The Digest Publishing Company, 1927.

INFECTIONS OF THE HAND. By Lionel R. Fifield, F.R.C.S. (Eng.). New York, Paul B. Hoeber, 1927.

KOMPENDIUM DER GEBURTSHILFE; EIN KURZES LEHRBUCH FUER STUDIERENDE UND AERZTE. By Dr. Walter Hannes. Berlin and Wien: Urban & Schwarzenberg, 1927.

TRABAJOS Y PUBLICACIONES DE LA CLINICA DEL PROFESSOR PEDRO ESCUDERO. vol. ii. Buenos Aires: "El Ateneo," 1926.

CHININUM. Scriptiones collectæ. Amsterdam: Bureau for Increasing the Use of Quinine.

PRINCIPLES OF PHYSICAL CHEMISTRY FOR MEDICAL STUDENTS. By Phyllis M. Tookey Kerridge, M.Sc., A.I.C. Introduction by Prof. A. V. Hill, M.S., F.R.S. New York: Oxford University Press, 1927.

APPLIED PHYSIOLOGY. By Samson Wright, M.D., M.R.-C.P. Introduction by Swale Vincent, M.D., LL.D., D.Sc., F.R.S. (Ed. & Canada). New York: Oxford University Press, 1926.

DISEASES OF THE HEART: THEIR DIAGNOSIS, PROGNOSIS, AND TREATMENT BY MODERN METHODS. By Frederick W. Price, M.D., F.R.S. (Edin.). New York: Oxford University Press, 1927.

ELEMENTS OF HYGIENE AND PUBLIC HEALTH; AN INTRODUCTION TO PREVENTIVE MEDICINE FOR STUDENTS AND PRACTITIONERS OF MEDICINE. By Charles Porter, M.D., B.Sc., M.R.C.P. (Edin.). 2d ed. New York: Oxford University Press, 1926.

THE ENLARGED PROSTATE. By Kenneth M. Walker, F.R.C.S., M.A., M.B., B.C. New York: Oxford University Press, 1926.

THE MEDICINE MAN; BEING THE MEMORIES OF FIFTY YEARS OF MEDICAL PROGRESS. By E. C. Dudley, M.D., LL.D. New York: J. H. Sears & Company, 1927.

X-RAY DIAGNOSIS; A MANUAL FOR SURGEONS, PRACTITIONERS, AND STUDENTS. By J. Magnus Redding, F.R.C.S. New York: William Wood and Company, 1927.

MANUAL OF MEDICINE. By A. S. Woodwark, C.M.G., C.B.E., M.D., F.R.C.P. 3d ed. New York: Oxford University Press, 1927.

COMPRESSION OF THE LUNG IN THE TREATMENT OF PULMONARY LESIONS. By Stuart Tidey, M.D. (Lond.), M.R.C.P. (Lond.). New York: Oxford University Press, 1927.

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INTERNATIONAL CLINICS; A QUARTERLY OF ILLUSTRATED CLINICAL LECTURES AND ESPECIALLY PREPARED ORIGINAL ARTICLES ON TREATMENT, MEDICINE, SURGERY, ETC. Edited by Henry W. Cattell, A.M., M.D., with the collaboration of others. vol. i. 37th Series, 1927. Philadelphia and London: J. B. Lippincott Company, 1927.

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CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

WALTER W. CHIPMAN, Montreal, *President* GEORGE D. STEWART, New York, *President-Elect*
FRANKLIN H. MARTIN, Chicago, *Director-General*

DETROIT COMMITTEE ON ARRANGEMENTS

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Sub-Committee on Eye, Ear, Nose and Throat Surgery

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PLANS FOR THE 1927 CLINICAL CONGRESS IN DETROIT

PLANS for the Seventeenth Annual Clinical Congress of the American College of Surgeons, to be held in Detroit October 3–7, 1927, are well under way under the leadership of a strong and representative committee of surgeons of Detroit and Ann Arbor. A program of clinics and demonstrations that will adequately represent the clinical activities in the hospitals in Detroit and Ann Arbor and at the medical school of the University at Ann Arbor and the Detroit College of Medicine and Surgery is being prepared and will be published at an early date. All departments of surgery will be represented therein including general surgery, gynecology, obstetrics, orthopedics, urology, and surgery of the eye, ear, nose and throat.

Clinics and demonstrations are being arranged for both morning and afternoon on each of the four days, Tuesday to Friday inclusive, at the following hospitals in Detroit: Children's, Deaconess, Detroit Eye, Ear, Nose and Throat, Detroit General, Henry Ford, Grace, Harper, Highland Park General, Jefferson Clinic and Diagnostic, Herman Kiefer, Michigan Mutual, Providence, St. Mary's, and Woman's, and at the University and St. Joseph's Hospitals in Ann Arbor. Special plans are being made by the members of the faculty of the medical school at the State university to entertain a large group of visitors each day.

The Executive Committee of the Congress is arranging a special series of clinical demonstrations illustrative of diagnosis, operative and postoperative treatment of surgical conditions, to be conducted by a group of eminent surgeons, including Prof. J. M. Munro-Kerr, of Glasgow, Scotland; T. de Martel, of Paris, France; William J. Mayo, of Rochester; George W. Crile, of Cleveland; John B. Deaver, of Philadelphia; J. M. T. Finney, of Baltimore, Eugene H. Pool, of New York; Barton Cook Hirst, of Philadelphia; John O. Polak, of Brooklyn; Frank A. Lahey, of Boston; Jabez N. Jackson, of Kansas City; George P. Muller, of Philadelphia, and others. These clinics will be given in Orchestra Hall where a large attendance can be comfortably accommodated.

Evening meetings on each of the five days of the session are planned. These will be held in Orchestra Hall, a new and beautiful auditorium located on Woodward Avenue not far from the headquarters hotels. At the Presidential Meeting, the first formal session of the Congress, on Monday evening, the president-elect, Dr. Georgd D. Stewart, of New York, will be inaugurated ane deliver the annual address. On the same evening the John B. Murphy oration in surgery will be delivered by Sir John Bland-Sutton of London. The annual convocation of the College will be held on Friday evening when the 1927 class of

candidates for fellowship in the College will be received.

General headquarters for the Congress will be established at the Book-Cadillac and Statler Hotels, both located on Washington Boulevard. At the former hotel will be found the registration and ticket bureaus, bulletin boards, exhibits, etc., while the large public rooms at the latter hotel will be utilized for clinical demonstrations and various scientific meetings.

An application for reduced railway fares on account of the meeting in Detroit is pending with the railways of the United States and Canada, and it is practically assured that a rate of one and one-half the regular one-way fare for the round trip on the certificate plan will be authorized for this meeting.

HOSPITAL CONFERENCE

The annual Hospital Conference will be held on Monday and Tuesday, morning and afternoon, the sessions on Monday being in Orchestra Hall and on Tuesday at the Statler Hotel. For Wednesday morning a symposium dealing with the standardization of the ophthalmological and otolaryngological departments in general hospitals is in preparation. The program includes papers, round table discussions, and practical demonstrations dealing with the many problems related to hospital efficiency, and will be of particular interest to surgeons, hospital trustees, executives and personnel generally. An invitation is extended to all persons interested in the hospital field to attend these conferences.

LIMITED ATTENDANCE—ADVANCE REGISTRATION

Attendance at the Detroit session will be limited to a number that can be comfortably accommodated at the clinics, the limit of attendance being based upon the result of a survey of the amphitheaters, operating rooms, and laboratories in the hospitals and medical schools as to their capacity for accommodating visitors. Under this plan it will be necessary for those who wish to attend to register in advance.

Attendance at clinics and demonstrations will be controlled by means of special clinic tickets, which plan has proved an efficient means of providing for the distribution of visiting surgeons among the several clinics and insures against overcrowding, as the number of tickets issued for any clinic is limited to the capacity of the room assigned to that clinic.

REGISTRATION FEE

A registration fee of $5.00 is required of each surgeon attending the annual Clinical Congress, such fees providing the funds with which to meet the expenses of the meeting. To each surgeon registering in advance a formal receipt for the registration fee is issued, which receipt is to be exchanged for a general admission card upon his registration at headquarters during the meeting. This card, which is nontransferable, must be presented to secure clinic tickets and admission to the evening meetings.

DETROIT HOTELS AND THEIR RATES

There are ample first-class hotel accommodations in Detroit for all who wish to attend, most of the hotels being located within short walking distance of the headquarters hotels. The Committee on Arrangements recommends the following hotels:

	Minimum Rates With Bath	
	Single Room	Double Room
Barlum, Cadillac Sq. at Bates	$2.50	$4.00
Book-Cadillac, Washington and Michigan	4.00	6.00
Carlton-Plaza, 2931 John R. St	2.50	4.00
Clifford, Clifford and Duffield	2.50	4.00
Detroit-Leland, Cass at Bagley	3.50	5.50
Fairbairn, Columbia and John R	2.50	4.00
Fort Shelby, Lafayette and First	3.00	4.50
Fort Wayne, Cass and Temple	2.50	3.50
Gotham, John R. and Orchestra Pl	2.50	3.50
Imperial, 26 Peterboro St	3.00	5.00
Madison-Lenox, Madison Ave	2.50	3.50
Norton, Jefferson and Griswold	2.75	4.50
Palmetto, John R. and Hancock	3.50	5.00
Royal Palms, 2305 Park Ave	3.50	5.00
Savoy, Adelaide and Woodward	2.50	4.00
Statler, Grand Circus Park	3.00	5.00
Stevenson, 46 Davenport	2.50	4.00
Strathmore, 70 W. Alexandrine	2.00	3.50
Tuller, Grand Circus Park	2.50	5.00
Webster Hall, 111 Putnam Ave	3.00	....

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